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A Mine Superintendent's House in the Tropics

June 18, 1921

The Copper Implements of the Copper Eskimo

By D. A. Cadzow

Suggestions for Looking After One's Health in the Tropics

By Lloyd T. Emory

The Mesopotamia Oil Controversy

By H. C. Morris

Molybdenum Mines in Norway

By Dr. E. O. Falkenberg

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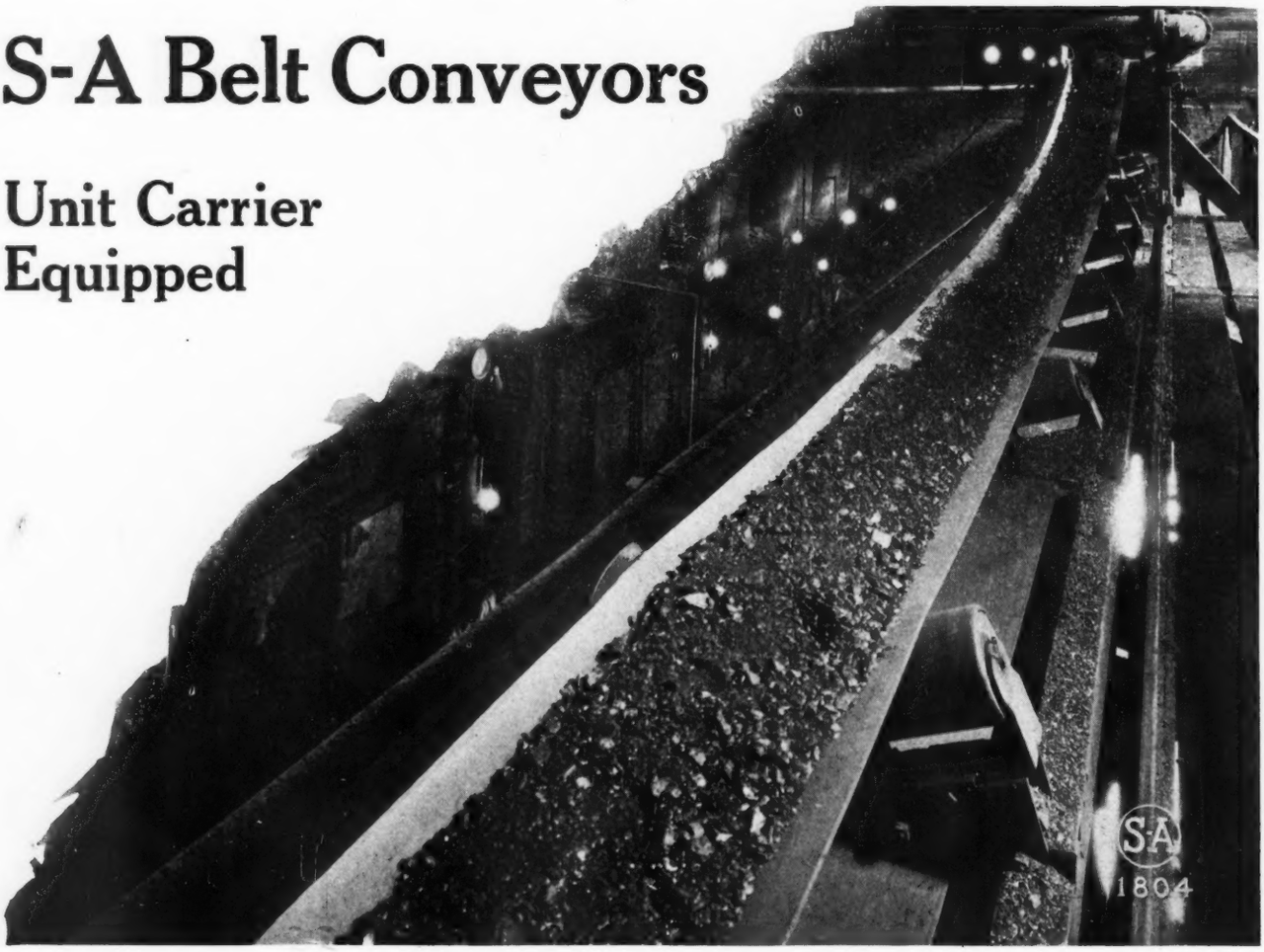

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Support the Mines Department Bill

THE BILL for a Department of Mines which has been introduced in the Senate by Senator Nicholson, of Colorado, provides that the proposed department shall cover all the mining and quarrying industries, including oil and gas, and that it shall cover the exploring, surveying, mining, treatment, and marketing of the metals or minerals. When, however, these products of the mines pass from the raw into the manufactured state they will pass out of the field of the Department of Mines and enter that of the Department of Commerce. Four bureaus and three divisions, each responsible directly to the Secretary, are provided: a Bureau of Mineral Technology, a Bureau of Mining and Applied Geology, a Bureau of Mineral Markets, and a Bureau of the Public Mineral Domain; a Division of Mineral Statistics, a Division of Publications, and a Division of Accounting and Disbursing.

The first two bureaus represent the present Bureau of Mines and the Geological Survey respectively, only with somewhat changed names, more appropriate to the field which they actually cover, and the real object of their organization. The Bureau of Mineral Markets covers the marketing of the products of the mines, and corresponds with the Bureau of Markets of the Agricultural Department, a department quite analogous to the proposed Mines Department. The Bureau of the Public Mineral Domain is essentially the present Land Office of the Interior Department, practically all of whose activities are concerned either directly or indirectly with the mineral lands of the public domain.

The three divisions are designed to perform the general functions which will serve all the bureaus jointly. All will need statistics, publications, and accounting, and a considerable administrative saving will be obtained by joining the work of all the bureaus in each of these particulars under one head.

The organization proposed leaves intact the organization and personnel of the Bureau of Mines and the Geological Survey as they exist; it creates an industrial or economic bureau to fill the gap which has been so acutely felt in the Government; it removes the long-standing difference between the Geological Survey and the Bureau of Mines as to who shall handle mineral statistics (which was recently in danger of being terminated by this activity being taken over by the Commerce Department), through the creation of an independent division of mineral statistics, to serve not only these two bureaus but the proposed Bureau of Mineral Markets as well.

The new department would entail little or no new expense on the Government. The only new feature would be the sorely needed Bureau of Markets, and part of this expense would be saved by the economies of merging the Statistics and Publications under one head.

A Department of Mines would give a home in the Government to an industry which provides by far the greater part of all the freight on our railroads, and which is one of the two great basic extractive industries of the greatest mining country of the world (the other, of course, being agriculture). Strange, indeed, with the overwhelming importance of this industry to the country, that no adequate recognition of it has ever been made in Washington. Producers of coal, of iron, of petroleum, copper, lead, silver, gold, and the dozens of other mineral industries, will have a complete organization devoted to their interests, and representing in a rounded way their business from prospecting to cashing in.

We think the mining industries—all of them—will not fail to get behind this most important measure, for such a department is more worthy and advisable than some already in existence. It is not a sectional measure: no state of the Union but is represented. It is by no means only a western measure. Coal and iron are eastern and southern industries chiefly; petroleum is a middle and southwestern industry largely, although not thus confined. Many of our central and even eastern seaboard states maintain state geological surveys which are in large part mining bureaus, devoted to fostering of the mineral industries of the state. We hope that all mining interests will get together and boost hard, for what is proposed is for the benefit of every citizen of the United States.

The Proposed New Mining Law

THE BILL to revise the mining laws of the United States, which has been transmitted by the committee of the U. S. Bureau of Mines of which Mr. W. R. Ingalls is chairman, is a notable piece of work, and one that is beforehand assured the respectful consideration of both houses of Congress. It is the culmination of much work done by the Mining and Metallurgical Society of America, in co-operation with the American Institute of Mining and Metallurgical Engineers, the American Mining Congress, and numerous other mining societies and organizations, which, having carried the work as far as it was able, requested the Bureau of Mines to appoint the present committee, which now consists, besides the chairman, of Messrs. Walter Douglas, J. Parke Channing, J. R. Finlay, John Hays Hammond, H. V. Winchell, and L. D. Ricketts. A great deal of work on the bill has been performed by Messrs. James R. Jones and Paul S. Black, law examiners for the U. S. Bureau of Mines, who have successively acted as secretary for the committee.

The bill provides for the repeal of the "apex law," as applied to mining claims erected in the future; and discards the principle of actual discovery of a mineral deposit as a prerequisite to the location of a claim,

while providing that discovery must be made before a claim is patented. The present requirements of assessment work for the holding of claims are modified.

A new feature is a provision whereby mine operators may purchase from the Government, at a fixed price per acre, the surface rights of ground for the storage of tailings, in order that such tailings may be preserved and worked at some future date when the present rich ores shall have been exhausted, and may not be allowed to be carried off by streams.

The new provisions cover all classes of metal deposits, but not coal or petroleum, or the mineral deposits which come under the leasing acts.

No rights to any mineral deposits acquired under the existing laws are disturbed.

We hope that this bill will secure prompt passage, and the mining industry should back it up heartily. It has no drawback. It is true that the iniquitous law of the extralateral rights has already done enormous damage, and that it cannot be repealed for existing claims; but there will be many new locations yet made which will be free of this incubus under the proposed law. And when the new law shall have been passed, it may become more common than now to have the owners of mining claims get together to boycott the apex law by vertical boundary agreements, a proceeding which we heartily recommend in all cases.

The enactment of the new provision regarding discovery, making an actual discovery of ore not necessary for the location and holding as unpatented ground of mining claims, is alone worth all the work which has been put into the bill. The old provision was one which encouraged mental dishonesty and disrespect for the law. Mineral land could only be located under the law by swearing to an actual discovery of ore, and there was no alternative in the numerous cases where land had to be located in order to explore it, but to comply with the law and perjure one's immortal soul. Out of this, of course, also arose a mess of law points and decisions. The new, common-sense provision will enable the prospector and miner to be at one and the same time law-abiding and truthful. And all that helps.

Successful Engineers Need Not Apply

THE CRITICAL ENGINEER, or rather, let us say, the engineer who is strictly ethical and carries his professional ideas to the point where he believes it is wrong to deviate one iota from the practice of his branch of engineering—the it-simply-isn't done attitude—will no doubt take exception to X's case as presented by Mr. Edward Thompson in our "What Others Think" of this issue. He will say, perhaps, that the man was "out of his line," that he should have stuck to mining, or that there is always an opening for a good mining engineer in strictly mining work. But this class of the "absolutely ethical" are, we believe, in the minority, and such an argument is quite unfair. There is not, or should not be, any foundation for this opinion; on the contrary, we know several bona fide mining engineers who have gone into work not intimately associated with mining and have been successful. One is a prosperous laundryman, another an agriculturist, and still another a clergyman—to say nothing of editors (ourselves excepted), advertising men, salesmen, and other classifications.

The engineering mind is, primarily, an analytical one, but its application, if it is to be successful in the generally accepted sense, must be tempered with judgment. Sauce for the goose is not always sauce for the gander, so that just what should constitute the proper mixture of these two adjuncts remains uncertain. We have heard from time to time of various recipes for a successful engineer, but, like Mr. Edison's questionnaire, they are open to criticism from one source or another, and cannot be considered a panacea for failure in one's profession.

Existence, for the most part, is comparative, but too frequently our basis of comparison is unfair. We overlook opportunity; often that which we term "luck" is nothing more than the application of good judgment, but we fail to appreciate it as such because we view the other fellow from our own standpoint. None of this proves the fault is with engineering or engineering education; it is rather with the individual. We are told to do so and so, to reason, and "to figure the logical thing." In this connection we can recall a paternal argument that was presented when we had perpetrated some youthful prank simply because "Bill told us to." "And I suppose if Bill told you to jump in the lake you would do that too." Then it was a case of poor judgment, but as time goes on we are supposed to acquire a certain amount of discretion. So, although the "logical thing" may be figured, the application should not be made until the proper proportion of "good judgment" has been added.

We agree with Mr. Thompson, however, that the profession can do a great deal to enlighten prospective mining students; indeed, to many of those who are now pursuing courses at the various mining schools. However, it might be well to bar the highly successful from giving an expression of opinion. Not that we maintain they have always had it easy—far from it; but their example will always be outstanding, whereas the other fellow may offer something that presents an entirely different view.

The Elimination of Waste

WE ARE PLEASED with the press-bulletin report of the American Engineering Council's Committee on Elimination of Waste in Industry. It places over 50 per cent of the responsibility for these wastes at the door of management, and less than 25 per cent at the door of labor. This is a great relief from the storming of labor organs about the ruinous rule of capital, and the groans of capital about the depreciation of labor; and it puts the lack of efficiency where most of us know, in general, that it belongs—in defective organization.

It is not so easy to see how we shall avoid errors of judgment in the future, just as in the past. The program outlined by the committee for this purpose involves "a national industrial information service to furnish more timely, regular and complete information covering current production and consumption and stocks of commodity; a national statistical service covering employment requirements; a national policy regarding public health should be fostered and encouraged; the material program for industrial rehabilitation should be encouraged and should offer opportunities for education and placement to those having physical defects as well as those handicapped because of industrial accidents; a nation-wide program of industrial standardization should be encouraged in conjunction with industrial intervals; the Government should recog-

nize the necessity for a revision of such Federal laws as interfere with the stabilization of industry; a body of principles should be accepted which could be developed for the adjustment and settlement of labor disputes."

To put the above recommendations more pithily, for our own survey, they seem to be, as we interpret them: (1) Monthly statistics of production, consumption and stocks of each commodity (by the Department of Commerce); (2) a Federal employment bureau (by the Department of Commerce or that of Labor); (3) a Department of Public Health (as advocated by President Harding); (4) the education of cripples and finding them jobs; (5) industrial standardization (through the Bureau of Standards, in co-operation with the industries); (6) the repeal of the Sherman Anti-Trust Law; (7) agreement between capital and labor.

It is striking that nearly the whole program is a Government program, along the lines of the increase of functions of the Federal Government and the tendency toward socialistic organization, in the best sense of the word.

By and large, we are impressed with the idea that the elimination of waste is a large subject, and that the solution is too great and too complex for any single report. We are inclined to think that mining engineers should start from the bottom in this problem, and work up—start with their own industry, which is certainly most wasteful and without adequate organization or guidance. Later on, perhaps, we shall be able to show the world by example as well as by precept.

Engineering Foundation Introduces The Alchemist

WE DID NOT SUPPOSE that Engineering Foundation would contribute our next installment of "Bedtime Stories for Mining Engineers," but we have received the following press bulletin, signed by Alfred D. Flinn, secretary:

TRANSMUTATION OF ELEMENTS

Dr. Charles Benson Davis, of New York City, claims in a paper which he has prepared and submitted to Engineering Foundation that he can make and has made some of the chemical elements, such as gold, silver, platinum, and copper, by transmutation of a common element. He has shown samples of the metals he claims to have made to members of the Engineering Foundation in New York City, and has requested that body to investigate his claims and his methods. Dr. Davis is a reputable chemist, a member of the Society of Chemical Industry, a Fellow of the British Chemical Society, and an honorary member of the Société Académique d'Histoire Internationale. He is the author of several papers which have been published in chemical journals.

A glance at the letterhead assures us that this is a serious matter, not to be treated lightly, as is our wont. It recalls to us the fact that Engineering Foundation represents the collective, concentrated, supersaturated wisdom and judgment of five great national engineering societies; and it bears, moreover, the specific names of fifteen superselected engineers, among whom are familiar to our own profession the names of Edwin Ludlow, Charles F. Rand, Robert M. Raymond, and Joseph W. Richards.

It goes, therefore, without saying that the bulletin would not have been sent to the press unless this last word in engineering tribunals believed that there was something in it. Had there been any reasonable doubt in their minds, of course, they would not have rushed into print before being able to offer the absolute proof. As it is, the only apparent reason for their doing so would apparently be to forestall the claims of other transmuters who might come forward at the same time with the same discovery. We sympathize with this: there is a man in Philadelphia, we have been informed repeatedly, who has been making gold out of base metals on the dead quiet for years. Some of our friends have been providing him with funds.

Let us fairly face the issue, then: Engineering Foundation knows, better than we, that the alchemist, the would-be converter of base metals into gold, has been multitudinous for hundreds of years. He antedated the chemist. It knows that a thousand claimants to success have been false alarms. It is a subject as elusive, hitherto, of successful and scientific demonstration as the divining rod or spirit materialization. Yet we cannot deny its possibility. If a long lanky individual stops you in the street and claims to be Napoleon Bonaparte you have no right to deny the possibility. What do you know of the possibilities of undiscovered psychic laws, or that the law of reincarnation may not be true? And if reincarnation, why not transmigration; and if transmigration, why not transmutation? Of course, the chances are immensely against your new friend being Napoleon, just as they are against Dr. Davis being the finally genuine alchemist: but you or we cannot deny the possibility.

The press dispatch states that Engineering Foundation has read Dr. Davis' paper and has seen the metals he claims to have made by the process; and it adds that Dr. Davis is a reputable chemist, a member and fellow of chemical societies, and an honorary member of the Société Académique d'Histoire Internationale—which, being translated, is the Academic Society of International History. Dr. Davis being an honorary member of this would indicate that International History is his chief specialty. *Histoire* also means a story, a tale, novel, or yarn.

Now, then, either Dr. Davis' claims are true or they are not true. We have studied logic enough to know that. Engineering Foundation does not think they are not true; otherwise it would not have advertised them under its auspices; therefore, it believes they may be true. Those who consider Engineering Foundation the last citadel of engineering judgment, conservation, and progress should act thereon: sell their mining stocks of "gold, silver, platinum, or copper." We face the end of the mining industry, for the production of metals from "a common element" will be a manufacturing proposition only, to be carried on wherever most convenient—certainly not in the present mining districts. We shall know by the bear movement in mining stocks just how much weight is given to the preliminary hunch of Engineering Foundation.

If, however, the unexpected should happen, and Dr. Davis cannot justify the good impression he has made, then we shall have to classify Engineering Foundation with the other suckers who buy divining rods and gold bricks. Certainly this necessity is unlikely, and we shall wire the American Mining Congress to advise Mr. McFadden to divert his energies to some more promising channel than trying to protect the gold industry, for if Engineering Foundation's suspicions are right, we may soon build bridges of gold, and be driven to using shells for money.

WHAT OTHERS THINK

Fact as a Basis for National Policy

Your editorial anent the French-English-American petroleum treaty in the May 21 issue of *Engineering and Mining Journal* is certainly well taken. Since I reached the age of reason and understanding, I have never been able to comprehend why the scientific man occupied the background in most of the efforts to settle great and important economic questions. There is certainly need of a change on the part of governments of the world in the disposition of matters of this kind, and, as you say, "we hail the dawn of a new era, when fact and science shall be the basis for national laws and international agreements, instead of the past ignorant makeshifts of uninformed politicians and so-called diplomats, and tugs-of-war between interested but stupid parties."

Every theory of human conduct must withstand the fires of experience. Otherwise it is a useless theory. The philosophies of nations and of individuals are constantly reshaped in the light of events. At some times the process is gradual; at other times great crises menace, and the most momentous consequences hang upon the decision.

A great many of the theories of the past will be dispensed with, and the manner of conducting national and international questions will be relegated to the scrap heap of political oblivion. Instead of the political diplomat, who buys with hot air and sells for gold, the economic issue will be settled by the geologist or engineer, who will deal with the facts of nature as they are.

Alexander Pope said that the proper study of mankind was man. Likewise the proper study of all economic questions will be the source of these questions, and who will be better able to do this than the economic geologist and mining engineer armed with the proper education and experience? May the precedent of placing Herbert Hoover in the President's Cabinet be extended in all directions, to the benefit of mankind.

Inverness, Fla. STRAUSS L. LLOYD.

The Engels Copper Mining Co.

The problem with the Engels brothers in the earlier days was to produce copper, gold, and silver at a low basic price at the mines. Iron and limestone were near and on the properties. Carbonate and oxide ores are only economically worked in a smelter. Our higher grades of sulphide ores are smelting ores, and lower grades require concentrating before treatment in the smelter.

We were stopped from using our smelter because so many did not understand our conditions and also because of the strong prejudice against smelter smoke that was caused from "heap roasting" or burning off the excess sulphur from heavily charged sulphurated ores in the open, and piled in heaps on the ground, which is not necessary with our ores. Our furnace was erected in 1909, and not in 1914, as stated in the *Engineering and Mining Journal* of May 28, 1921.

San Francisco. HENRY ENGELS.

What Is the Matter With Mining Engineering?

Recently I noticed in one of the magazines an advertisement for a well and favorably known mining school. This read, in part, as follows: "Mining Engineering for Your Profession. A wide and profitable field, not overcrowded." Quite probably I should have taken little notice of this (not that I spurn the reading of advertisements; on the contrary, I find them fully as interesting as much of the text) had it not been for the fact that I had received that morning a letter from a fellow engineer concerning a graduate from this same school. I take the liberty of quoting: "I incidently ran across 'X,' whom you may or may not remember. He is here working for the city engineering department, at street cleaner's wages, and is studying stenography to improve his condition. Now, I ask you, what is the matter with mining engineering when graduates of twelve-years' standing study stenography to place themselves on a equivalent earning plane with the six-months' (or shorter period) student of a business school?

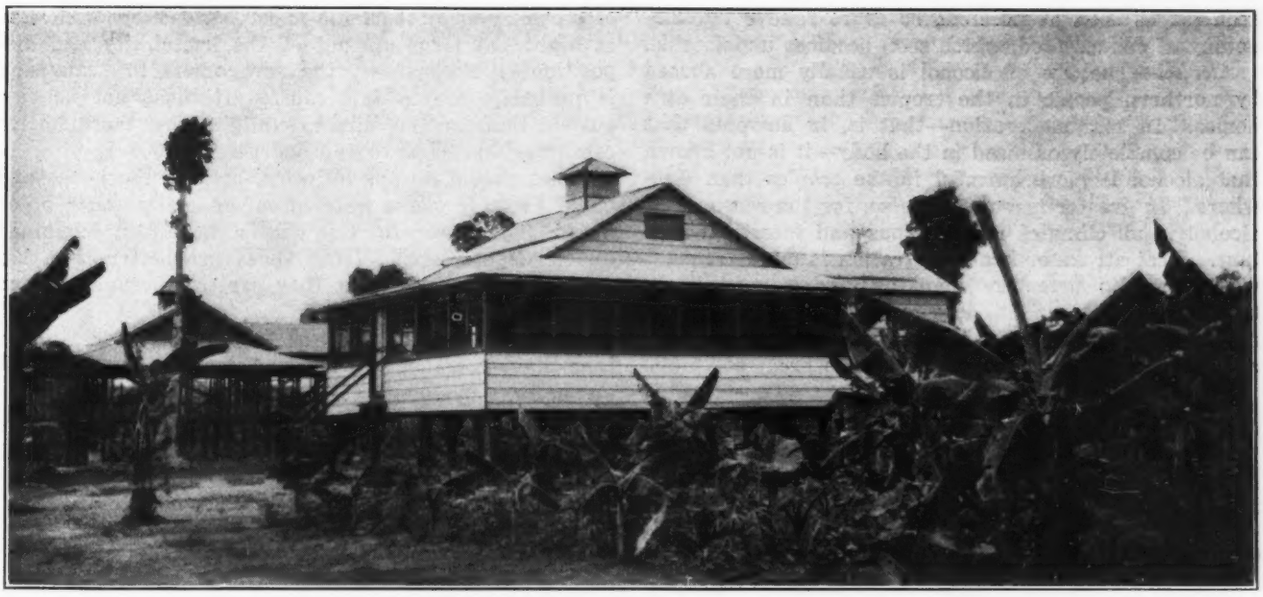
"And yet the colleges still keep grinding out technical men. It seems a crime to educate engineers; it unfits them for business life, and that is the only life if you are not born rich. Engineering teaches you to follow an idea to a logical conclusion. Given certain conditions, the engineer can reason that certain things will happen. When he figures on what men will do, he applies the same principle. He figures the logical thing—and how often do men do the logical thing? He figures if he is industrious and faithful he will succeed—and how many times does he?"

During a period such as we are now experiencing it is quite probable that the field is overcrowded, which is not in accordance with the statement in the advertisement above mentioned. But let us assume a normal condition of affairs—mines, mills, and smelters operating to capacity—and what then? Is such a statement to be accepted as justifiable under those circumstances?

Consider the fact that we have in this country today six hundred universities and colleges—more or less—and at least half of these include an engineering course—mining, civil, electrical, mechanical, civil or a combination of them—in their curricula. True enough, an increase in technical schools has been brought about by a demand; but has that demand come from industry, from a clamor on the part of the prospective student, or is it a form of propaganda to increase attendance at various schools? It is futile to attempt to place responsibility for the conditions noted, until the facts pertinent to the whole matter are more definitely established.

Of all the professions, probably the most romantic to the layman is that of the engineer; but romance goes out of the window oftentimes when the facts are shown in their full significance. It seems to me that mining and other engineers can perform a service not only to themselves but to those who contemplate entering the profession by giving publicity to such possibilities as are offered by their profession and also pointing out the drawbacks. Education comes dear, and though it is all very well to say that success or failure is up to the individual, the prospective student should have the benefit of the experience of those who have been "through the mill." EDWARD THOMPSON.

New York City.



TYPICAL COTTAGE FOR USE OF WHITES IN A TROPICAL COUNTRY

Looking After One's Health in the Tropics

Practical Suggestions Concerning Routine Avoidance of Infection and Pollution Common to Warm Climates—Cleanliness, Care in the Preparation Of Food, Sufficient Sleep, and Abstinence From the Use of Alcoholic Beverages Assure Comparative Immunity From Sickness and Disease

By Lloyd Tilghman Emory
Written for *Engineering and Mining Journal*

THE general principles of hygiene are the same the world over, and may be applied in any climate. They aim to keep the body sound, free from infection, and at its maximum efficiency. The danger to life and health is greater in nearly all tropical countries than in those that are temperate, owing to a number of causes, among which the most noteworthy is the almost total neglect or ignorance of sanitation among tropical peoples, the high, even temperature and moist atmosphere in which disease-producing organisms flourish and multiply, the great abundance of insect life, and the common pollution of water supplies.

It is sometimes said that the safest procedure in matters of hygiene in strange countries is to conform to the habits of the natives, but this is often a serious error, and has undoubtedly cost many visitors to the tropics their health. Faulty hygienic habits in the natives help to keep alive in the tropics many diseases that have disappeared or are under control in the temperate climates.

Sources of Infection

Water—Sojourners in the tropics are likely to suffer from water-borne diseases; namely, typhoid, dysentery, cholera, and intestinal parasites. The only safe rule for general application to *drinking water* in the tropics is that it should be sterilized by boiling or chemical treatment; but the first treatment alone is not sufficient. The water must be kept sterile until consumed, by being put in sterile containers, closed against dust and other contaminations. Native servants are so entirely ignorant of the very meaning of sanitary precautions that they are continually guilty of such actions as stoppering bottles of distilled water with corks they have held in their mouths, wiping out a drinking glass with a dirty rag or paper picked from the floor, drinking direct from the bottles, or washing bottles in unboiled water before filling them.

Food—It is generally asserted, and is theoretically true, that less food is required in the tropics than in colder climates, and the consumption of fats and proteids in particular should be considerably reduced. This, however, should not be attempted by the new arrival, and past habits and temperaments should be considered. The sugars and starches are well adapted to the tropics, as they are not so heating as fats and proteids, and, as a rule, fresh, well-cooked fish is preferable to beef and other meats. Organic acids, such as fruit juices, are especially valuable as well as agreeable, and should be used freely.

Care must be exercised in the use of fresh fruits and green vegetables, not because they in themselves and harmful, but because it is impossible to, disinfect them, and for the reason that they are likely to be contaminated, from unclean water or fecal manuring, with parasites causing intestinal diseases. Fruits such as bananas, mangoes, oranges, and others that are indigenous to the tropics should be thoroughly washed in boiled water, and care taken that they are not over-ripe and that their skins are not broken. The above also applies to salads, which, even under the best conditions, are dangerous. Green vegetables should be thoroughly sterilized by cooking. The habit of eating rice, yams, tannias, cassava, and other native vegetables should be

acquired as soon as possible, so as to relieve the monotony of canned food, which soon becomes unpalatable.

Alcohol—The use of alcohol is usually more abused by northern people in the tropics than in their own homes. In real moderation—that is, in amounts that can be completely oxidized in the body—it is not known that alcohol is more harmful in the tropics than elsewhere. In greater amounts it is so, for the reason that alcohol in all climates is a nervous and intestinal irritant. Heat stroke or heat prostration is more frequent with men who have been drinking, and is more likely to be severe when it does occur. Recurrences of malaria and dysentery are not infrequently brought about by drinking sprees. Alcohol also predisposes one

PARKED RIVER FRONTAGE IN THE TROPICS

in more indirect ways to disease infection, such as rendering a man careless in his choice of associates, neglectful of the quality of his food, or the use of his mosquito net. Hence it is safest to leave it entirely alone.

There is little to say about clothing that does not apply in colder climates. In the tropics one should wear what is comfortable, but, owing to excessive perspiration, wash clothes are preferable. Clothes should be boiled in washing, and dried on a line, not on shrubs and grass. For men doing active work, fresh clothes should be worn every day, and light woolens have many points to recommend them. A hat, or preferably a sun-helmet, should always be worn, owing to the effects of the actinic rays of the sun. Just how much effect these rays have is a matter for debate, but they apparently cause severe headaches in some persons, during the day, often followed by insomnia and other nervous disorders at night. A large amount of the irritability and disposition on the part of the new-comers to "blow up" is probably due to this cause. It must not be forgotten that in the direct sunlight the thermometer often registers 150 to 160 degrees F.

Shoes should always be worn, both in the house and out; in muddy places water-proof or nearly water-proof boots. The reason for this will be more fully explained under "Hookworm." High shoes are better than oxfords for general use, as they protect the ankles from mosquitos and street filth.

Exercise—Regular exercise is probably more important than at home, and is more likely to be neglected, owing to the cheapness of servants and the general relaxation due to a mild, uniform climate. Tennis and golf are probably the best form for office men, as they are not only exercise but they lend an opportunity for the social intercourse so essential to keep one in good spirits.

Bathing—Bathing should be indulged in as often as possible, but is safest under a shower bath, using 5 per cent carbolic or sulphur soap, as skin diseases are more frequent than in the north. A rub-down with bay rum adds considerably to the refreshing effect, and an antiseptic (unscented) powder will be found useful in preventing chafing from heat. For men doing exploration in the bush, Calverts' 20 per cent carbolic soap prevents many infections. It also helps to remove such insects as "bête-rouge" and "ticks." A sponge-off with a formalin solution consisting of a teaspoonful to a pint of water prevents prickly heat, chafing, and dobie-itch.

If clothes become wet from a shower or perspiration, little damage is done as long as the person continues to exercise, but the clothing should be changed at once on reaching camp.

Sleep—More sleep is required in the tropics than at home. Eight hours a night should be the minimum, and a short nap after the mid-day meal is very beneficial to one's health and spirits.

Mosquitos—Certain tropical mosquitos are to be feared as disease carriers, and are truthfully spoken of as "winged serpents." The most frequent diseases, yellow fever, malaria, dengue, and filaria, are now known to be transmitted by them, to say nothing of mosquito worms and other local infections. Unfortunately, one never knows unless he is familiar with the appearances of the species whether the mosquito that has first bitten him is an innocent insect or a serious disease carrier.

Malaria is probably the most prevalent disease, and in some regions 80 per cent of the population is infected; therefore every precaution should be taken to prevent being bitten by mosquitos. The anopheles mosquito appears about the house before dark; hence the importance of being behind screens after sundown and sleeping under nets. However, the appetite of the female anopheles for blood is such that she will fly for distances up to one or two miles to reach the human victim whom she apparently scents, and will spend hours working over a screen or net endeavoring to find a broken thread.

The filaria mosquito has entirely different habits. It breeds in filthy drains close to human habitations, and hides during the day in dark corners of rooms, from which it does not hesitate to swoop out even at mid-day if a victim comes along. Filaria is exceedingly common

in the Guianas. The advanced stage of the disease manifests itself as elephantiasis, or "Barbados leg," causing the swollen legs and feet that one so often sees on the streets of tropical towns. Therefore: *first, last and all the time,* don't let mosquitos bite you. Wear high shoes; use citronella on your socks; and have your room screened or sleep under a net.

Hookworm—The hookworm is an intestinal parasite which gets into the body, in particular through the skin of the feet, but also through that of other parts. The

PERMANENT BUILDINGS BEING ERECTED FOR LABORERS

disease is easily cured, but more easily prevented by wearing shoes all the time, drinking boiled water, and eating well-cooked food.

There are a number of other intestinal parasites common to the tropics, the most familiar of which are round worm, whip worm, tape worm, balantidium coli, and bilharzia.

Hook, Round and Whip Worms—All tropical natives have some or all of these worms, which are a serious menace to health. By observing the following rules they can probably be avoided:

1. Do not walk barefooted under any condition, as these worms can enter the system through the skin. Always wear shoes or slippers whether you are outside or inside of your room.

LABORERS' SHELTERS IN A PRELIMINARY CAMP BUILT OF ROUND POLES AND PALM THATCH

2. Do not eat food brought in from the surrounding country unless it has been well washed and cooked.

3. Be sure to wash your hands after handling articles bought from the natives, and especially before meals, when you directly or indirectly touch your mouth with your fingers.

4. Servants and washwomen who do not look healthy should be examined by a doctor. If he finds them infected, they should receive proper treatment, so that they cannot transmit the disease.

Tape Worms and Balantidium Coli—These usually follow eating inadequately cooked pork. Take care not to eat pork unless it is properly washed and cooked.

Bilharzia—Comes from drinking water; hence observe the rules noted under *Water.*

Many kinds of skin disease can be contracted in the tropics. It is advisable to wash the hands frequently with antiseptic soap, especially after handling articles used by natives. Disease carriers such as rats, flies, fleas, roaches, and mosquitos should be exterminated at every opportunity. Every one should be inoculated against typhoid.

Look at most of the natives you pass on the street, and note how worn out they appear to be. This is due chiefly to hookworm, alcohol, malaria, filaria, and venereal diseases, all of which can be avoided by sanitation, care, and correct living. To sum up: Keep away from mosquitos, get plenty of sleep, eat with moderation, leave alcoholic drinks alone, take regular exercise, and don't worry about your health.

Manganese Deposits Near Volta Grande, Brazil

Graphite and Psilomelane Found Together and in Process of Being Separated and Concentrated By Natural Means

BY HORACE E. WILLIAMS
Written for *Engineering and Mining Journal*

THE graphitic manganiferous deposits of Volta Grande, in Minas Geraes, Brazil, are specially interesting both because of the occurrence of these two minerals together, as well as for the manner in which they have been and are being separated by natural processes. The occurrence is on a ridge 1,600 m. north of the Rio

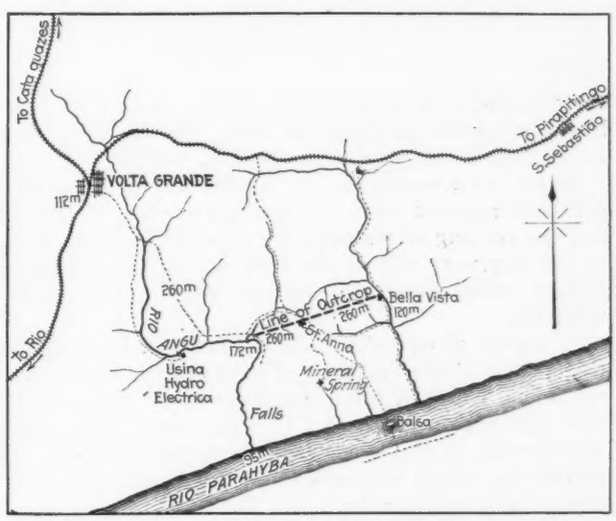


FIG. 1. MAP OF VOLTA GRANDE DISTRICT, MINAS GERAES, BRAZIL

Parahyba and about 6 to 8 km. east-southeast of the station of Volta Grande on the Leopoldina railway in the southeastern part of the state.

As shown on the sketch map, the exposures of this mineral band extend across the hills in a straight line from the Rio Angú to Bella Vista, a distance of over

three kilometers. Beyond these limits, no exposures have been reported, though a systematic search would probably reveal the continuation of the outcrop. The accompanying sketch is a longitudinal section along the vein and shows the four depressions existing between the Angú and Bella Vista. In this section the heavy shaded line at the top of the hills shows where the manganese ore, psilomelane, occurs in considerable quantities, and the depressions between these hills are occupied by the graphite concentrations.

In the depression at *A* a ditch was run in the hillside across the strike, which gave a good section of the material at this place. This section shows a thickness of about 4.35 m., inclosed in the decomposed gneiss, the lower part of which, about 3 m. thick, consists of a tough massive but rather soft material, quite graphitic, with considerable manganese and mica. Above this is a brown earthy umber containing many patches of kaolin and frequent blocks of a siliceous manganiferous rock. Near by, and in the flats just below to the south, large blocks of fairly rich graphite appear on the surface and in the soil covering. Similar deposits of graphite occur in the other depressions along the line of outcrop.

However, the exposures seen in the open cuts on the hilltops, where considerable mining for manganese was carried on during the war, seem to provide a better conception of the nature and evolution of these mineral deposits than can be inferred from the section at *A*. The section observed at these places is fairly uniform, though that at the east end of the outcrops above Bella Vista is the deepest and reveals the situation to best advantage. At this place the surface ore has been removed for a distance of about 400 m. across the top of

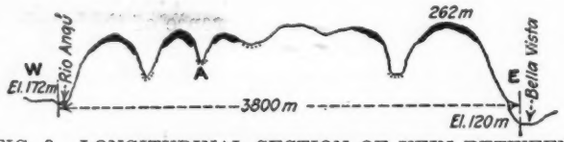


FIG. 2. LONGITUDINAL SECTION OF VEIN BETWEEN RIO ANGU AND BELLA VISTA

the hill, and a cut about 70 m. long by 10 to 12 m. deep has been opened up along the vein. The strike is about N. 70 deg. E, dipping 60 to 70 deg. north.

In all these exposures the accumulations of surface ore have resulted from the gradual erosion of the soil and the settling of the hard ore toward the south, owing to the northerly dip of the bed, which, on digging, is always found under the northern edge of this surface material.

In the cut above Bella Vista the material is about 2 m. thick, consisting principally of hard ore and kaolin, with scattering blocks of ore in the decomposed gneiss of the foot wall over a width of 2 to 3 m. Also in the cracks and crevices of this gneiss thin irregular sheets of rich tabular ore occur in considerable quantities. The hard ore has a spongy structure and has to be broken up into small pieces to free it from the inclosed earthy matter. The ten or twelve thousand tons of surface ore from the surface diggings were thus broken up and washed before shipment during the war. Several thousand tons of this washed ore are still in the vicinity awaiting shipment.

As may be inferred from the region above Bella Vista, the large accumulations of surface ore, consisting principally of psilomelane, have resulted from the oxidation and hydration of the mineral, originally largely carbonates and silicates. With increase in depth, the spongy ore gradually decreases in amount, the mineral becoming more massive but decreasing in density, with a perceptible increase in the siliceous and graphitic content.

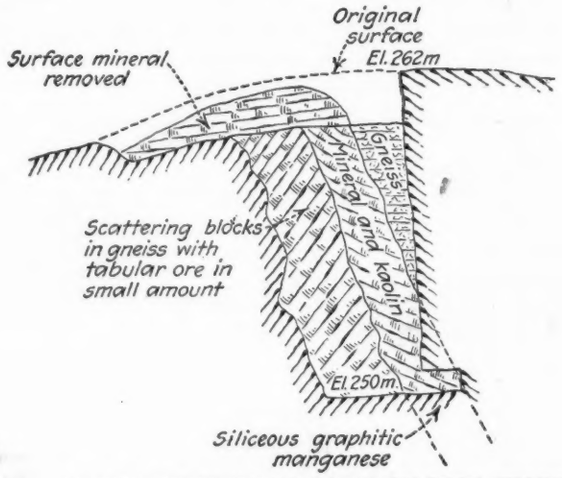


FIG. 3. TYPICAL SECTION AT POINT ON VEIN SHOWING MATERIAL REMOVED FROM CUT

This region is one of comparatively heavy rainfall, about 200 cm. annually, the result of which has been to effect a double concentration: removing the graphite content largely from the manganese ore and carrying it down the slopes to deposit it in the depressions and near-by flats.

In the several exposures seen the rocks were completely decomposed, so that the determination of the character of the original rock of this formation is as yet impossible. However, the character of much of the kaolin found would indicate a deposit similar to a pegmatite. Frequently, what appear to be decomposed crystals of diagolite are found in these occurrences of kaolin.

An interesting problem would be to work out the probable changes through which an ordinary deposit of wad and lignite would pass on being subjected to the forces of metamorphism such as these rocks have undergone.

Production of Metals in Mexico During 1920

The following table, supplied by the financial agent of the Mexican government in New York City, gives the metal production of Mexico in 1920.

(Figures in Kilograms)

	Presented for Export	Presented for Coinage	Total Production	Commercial Value
Gold	7,255.427	15,608.8887	(a) 22,864.3157	$30,485,678.00
Silver	1,801,173.464	267,764.764	(b) 2,068,938.228	134,232,712.00
Lead	82,517,598.000	.....	82,517,598.000	28,881,159.00
Copper	49,192,401.000	.....	49,192,401.000	37,878,149.00
Zinc	15,650,590.000	.....	15,650,590.000	5,321,200.00
Mercury	75,748.400	.....	75,748.400	360,562.00
Manganese	1,137,400.000	.....	1,137,400.000	1,603,734.00
Graphite	3,222,941.000	.....	3,222,941.000	483,441.00
Antimony	622,572.000	.....	622,572.000	230,352.00
Tungsten	40,020.000	.....	40,020.000	111,256.00
Molybdenum	4,230.000	.....	4,230.000	13,620.00
Arsenic	2,091,704.000	.....	2,091,704.000	1,338,691.00
Totals	156,363,633.291	283,373.6527	156,647,006.9437	$240,940,554.00

(a) Of this quantity of gold 15,603 kilograms was coined. (b) Of this quantity of silver 223,068 kilograms was coined.

Note.—To fix the value of the metals, average New York quotations were used.

Molybdenum Mines in Norway*

Production Was Greatly Stimulated by War Prices of Molybdenum—Many Important Norwegian Companies Working Deposits Geologically Similar To Those Found Elsewhere in the World—A Possible Boom in the Metal

BY DR. EUGENE OTTO FALKENBERG

THE WAR CREATED a great demand for most metals, and especially for those used in alloy steels, i.e., manganese, nickel, chromium, tungsten, molybdenum, and vanadium. Only small deposits of manganese occur in Norway, but the country possesses a considerable amount of nickel, and the development that has taken place in the nickel industry is probably fairly well known. The deposits of chromium in Norway are not large, but were worked during the war, and the ore was exported. It is to be regretted, however, that this has not created a mining industry which is likely to continue in competition with the outside world, so that Norway's chrome deposits must probably still be considered as of interest only to economic geologists. There have been no new discoveries of any considerable size. The tungsten deposits hitherto known are found in Orsdalen, near Ekersund, and are relatively small. It is still hoped that the deposits in which tungsten is found with molybdenum may be profitably developed.

It would be of advantage if the prospectors all over the country had a better knowledge of the tungsten minerals, as these, unlike the blue molybdenum and the glistening golden pyrite, are easily overlooked even by an experienced prospector. The geology of Norway gives ground for hope that tungsten deposits larger and richer than those now known will be discovered. Vanadium is found in Norway only as a component of other ores, and in such small amounts that it cannot be profitably extracted at present. The remaining steel-improving metal is molybdenum, and it is of this that I shall speak.

Norway has only one molybdenum mineral, molybdenite, which, however, occurs in considerable quantities, and in a number of localities, especially in the southern part: in Lister, Mandals, and Stavanger amts. It is also found in Nordlands amt.

EARLY DISCOVERIES OF MOLYBDENITE

Before the war the production of molybdenite in Norway was small and irregular. The first production of which I know took place from the Knaben mine at Flekkefjord, presumably at the end of the eighteenth century or the beginning of the nineteenth, as upon the resumption of work on these rich deposits in the 80's, old tools and other indications were found which pointed to previous activity here. This also agrees with the stories in those parts about mountain peasants bringing ore over the mountain to Kristiansand and Stavanger, where they exchanged a pound of molybdenite for a pound of butter. The molybdenite was used as a lubricant and a polish for stoves. In these long past times it was usual to call molybdenite "silver stone," later "lead-pencil stone," and one often finds names like "Pencil Mountain," and "Silver Deep," at the deposits.

In the 80's, at about the same time as the resumption of work in the Knaben mine, the Tjoerdalskamp, in Saltdal, was discovered, and work was started, but it was abandoned after a few years, probably because the deposit was exhausted. The activity from 1880 to 1900 was on the whole small and irregular, the price being only about two kroner per kilogram. The demand was also light, the product being used only in color factories and for certain special unimportant chemical uses. During the introduction of special steel in the period from 1900 to 1910, there was technical but no great amount of general interest in the metal. From 1910 to 1913 production was fairly steady, not exceeding Kr. 15,000 for any one year.

In 1913, the Kvina mine, the first to use modern concentrators (flotation), was started. In 1914, the Knaben mine was reopened, so that at the outbreak of the war two mines were producing, but by the close of the war a series of greater and smaller deposits were being worked, especially in the southern part of the country, where operation had been resumed, so that there are now at least fifteen Norwegian mines producing molybdenite. The prices must have, of course, the credit for this blossoming out of molybdenum mines. I must say the credit, and not the blame, despite the fact that there are many who have been "burnt" by molybdenum.

RAPID RISE IN PRICE OF MOLYBDENUM

The price rose for several reasons:

1. The demand was already steadily increasing from early in the year 1913 and the price was then 5s. per kg. pure MoS_2, and by the outbreak of the war the price had risen to about 13s. The English government, as known, set the maximum price at 105s. per unit, and this price was the usual maximum price in the Entente countries in the early part of the war.

2. Germany was cut off from its usual overseas supply of steel-alloying metals (manganese, nickel, wolfram, molybdenum, and vanadium) and had to obtain what it could by the few avenues still open, almost regardless of cost. Except for some nickel and chrome, it had to depend principally on molybdenum. Even if the Germans are clever in making substitutes, they could not get along without these metals, and that is a point that should not be forgotten in days of depression. They announced often enough that they now no longer needed our molybdenum, but still they paid the increasingly greater price demanded, on account of the constantly increasing cost of production. This again caused the price to rise gradually to Kr. 18 to 20 per kg., with a stop here for a while. Later, however, about Kr. 25 was obtained. One mine then made a contract at a price of Kr. 35, which came to be a standard price. Some ore sold as high as Kr. 40 per kg.

As is commonly known, in the summer of 1917 the British government entered into a contract with all of the Norwegian mines for the purchase of their produc-

*Translated and abstracted from a lecture before the Norwegian Mining Industry Association, as published in *Teknisk Ukeblad*, Vol. 68, Jan. 7, 1921.

tion during 1917 and obtained an option from Jan. 1, 1918, on all molybdenite produced. By this arrangement the price was, if possible, still further stabilized. This, of course, was done only to prevent the product from going to Germany.

In this connection I want to express my regrets that the Norwegian mines at that time did not work together as closely as they have since done. With a combination behind them such as A/S Norske Molybdenprodukter much more satisfactory and safe contracts could have been obtained. The great and all-too-sudden rise in price led to speculating in molybdenum deposits, and all know where speculation leads. In the beginning it was called investment in stocks, and, as always, in prosperous times, caution was put on the shelf. It must be considered as somewhat hasty to start large companies on the basis of the report of some man with a "wishing twig" who claims to have discovered that unsuspected masses of molybdenum are found in a certain locality, where the professional man distinctly warns against anything more comprehensive than a moderate investigation.

Many Important Producers in Norway

We in Norway, however, have shown sufficient molybdenite so that the steel producers of the world will have to consider it in their calculations for producing molybdenum steel. I shall now consider the various molybdenum mines in Norway, as there are so many new companies that it is here possible to treat of them only in general. Some of these mines have already stopped work or failed; others will, without doubt, never start operations. The capital invested, in proportion to the production of the mines, is disproportionately large, and, including the loans raised by the companies, can certainly be set at twenty million kroner.

Until the end of 1917 there were only three considerable producers, namely:

1. Knaben mines, in Tjotland, with a total production of about 275 metric tons pure MoS_2.
2. A/S Kvina mines, in Tjotland, with 150 metric tons pure MoS_2.
3. A/S Dalen mines, in Telemarken, with 100 metric tons pure MoS_2.

The quantity of concentrate delivered by other mines was small. The principal production outside of the three first-named mines came from three others:

4. Tjaerdalskampen, in Saltdalen, production in the 80's about 10 metric tons pure MoS_2.
5. Vatterfjord pr. Solvaer has probably also produced 10 metric tons pure MoS_2.
6. Haugholmen, in Telemarken, has produced 15 metric tons pure MoS_2.

Of the new mines which have produced the most important are: Ornehommen mine, total production about 15 metric tons MoS_2; Knaben mine No. 2, total production about 25 tons; Gursli mine, total production about 45 tons; Undalen mine, total production about 32 tons; Syversvolden mine, total production about 3 tons; Lier Molybden A/S, total production about 4 tons.

This gives a total production of molybdenite in Norway up to date of about 800 tons pure MoS_2. These are the most important molybdenum mines now in operation. Besides this, it is reported that preliminary investigations in the Laksedals field, in Gildeskaal, in Nordland, have shown large quantities of relatively rich concentrating ore. It seems sure, therefore, that, considering the new, and, in part, rich deposits which were opened during the war, Norway will be able to furnish a production of at least 150 to 200 metric tons pure MoS_2 per year, provided that the price remains satisfactory.

Similarity in Occurrence of Molybdenum Deposits

Molybdenite is usually intimately connected with acid rocks, principally granite. This applies not only to the Norwegian but also to the Swedish, Australian, Canadian, and United States molybdenite deposits. In the last phase of the extrusion of the granite masses, the magma has given off a part of its molybdenum contents. At the same time there was a plentiful segregation of silica in the form of quartz, and the geologist constantly finds molybdenite associated with quartz, at some places in pure quartz veins, which are generally closely connected with a granitic magma. It is clear that all deposits cannot be ascribed to a "magmatic origin," for as in the formation of pegmatite veins, all the transition steps between pneumatolysis and crystallization from solutions are to be noted.

The downward continuation of the deposits is, of course, a question of the utmost interest. Experience seems to have shown that the extent of a molybdenite deposit is relatively limited, compared with deposits of iron ore, pyrite, and other ores which occur in great quantities, usually with 30 to 40 per cent and more iron and sulphur. The downward dimension seems also to be quite limited, and there is probably no molybdenum mine over 100 ft. deep. It is, therefore, important to investigate the deposits before tying up too much capital in them. As far as the Mineralselskapets property is concerned, and it holds good for about all the Norwegian deposits, there are found, besides molybdenite, copper and iron pyrite and vein materials, quartz (of varying colors), feldspar, hornblende, biotite, and sometimes muscovite. In some deposits, fluorspar (green and violet), tourmaline (black), calcite, augite, and epidote occasionally appear. At one deposit magnetite, granite and other gangue minerals occur. Wolframite and scheelite occur in Orsdals fields, and bismuthinite and some arsenopyrite at the Telemarken deposits, and apatite at the Resör deposits.

Two Grades of Product Obtained

The method of concentrating the ore differs according to whether one is dealing with deposits of the vein type or of the impregnation type. With the vein type the ore is generally subjected to a separation whereby one or more other directly salable products are obtained, No. 1 concentrate with 80 to 90 per cent MoS_2, and No. 2 concentrate with 50 to 60 per cent MoS_2. The tailings from deposits of the vein type usually contain from one-half of 1 per cent to about 1 per cent MoS_2. In deposits of the impregnation type the ore generally carries considerably less than one-half of 1 per cent, but on the other hand considerably larger quantities can be broken and forwarded to the mills. A content of one-quarter of 1 per cent molybdenum will probably prove to be the average for the Norwegian deposits of this type. In preliminary calculations the great error is usually made of putting these figures much too high.

The concentration of molybdenite is, contrary to earlier statements from foreign sources, quite simple, and the course in the mills is usually according to the following flow sheet: Ore from mine to rock crusher, to picking belt, to ball mill, and thence to Elmore flotation machines.

The rock crusher is usually of the Blake type. The ball mill has calypsol or ball bearings. One concern has installed Hardinge mills with a Dorr classifier. The separation is always by flotation, and Elmore machines are most used. Lately Minerals Separation machines have come into use. In Canada, Callow machines are most used. The concentrate obtained in this way generally carries about 70 to 80 per cent MoS_2. In Canada a concentrate of from 85 to 90 per cent MoS_2 is obtained, but I do not believe the copper pyrite is so bothersome there as in Norway. If the concentrate contains too much copper it must be oxidized and separated magnetically to lower the copper contents sufficiently, preferably to 0.3 to 0.5 per cent Cu.

The uses of molybdenite in the technical industries are many, but as a rule only small quantities are required. The principal use of molybdenum is in the production of molybdenum steel.

Study of Molybdenum Steel and Its Uses Imperative

It cannot be denied that there is not yet even approximate agreement about the value of molybdenum steel. Norwegian metallurgists should not, however, be satisfied with the investigations of others, and it is part of A/S Norske Molybdenprodukters' program also to take up this question and attempt a solution. For this purpose the company should have the necessary assistance from the state. With the large deposits which exist in Norway, and with the capital which already is invested in Norwegian molybdenum, about Kr. 20,000,000, it is necessary to try to find a solution.

In regard to the prospects of the industry in Norway, it is difficult to make a prediction, but I am of the opinion that in the not distant future Norway will again have a "boom" in molybdenum.

Placer Gold in Indiana

State Geologist in 1902, on Strength of Occurrences in Morgan County, Forecast Discovery of Veins in Ontario

By C. Hafer

Written for *Engineering and Mining Journal*

SOME MONTHS AGO, at a meeting of the Canadian Mining Institute, the question arose as to the whereabouts of the placers from erosion of the Ontario gold veins. Without knowing anything of Ontario gold deposits, either in place or fragmental, I am inclined to believe that they may have been removed during the glacial period, scattered over the drift-covered area of the interior northern states, and, in some places concentrated, forming placers of sufficient richness to suggest near-by gold veins and affording a field of effort to the inexperienced.

Among numerous localities where gold has been found in the drift-covered region, the most important is probably Indiana. Little known to miners throughout the world, this field has awakened considerable interest in the Middle West, and has been the scene of activity, at intervals, with little profitable result, as far as I know. In 1901-02 I spent part of the two summers there panning and testing the deposits with a sluice box. The counties of Brown and Morgan, lying forty to sixty miles southwest of Indianapolis, are the ones most prospected for gold, though there are a number of others from which gold has been reported.

In Morgan County, the surface features are typical of the Middle West, in general flat, with valleys carved by streams. No igneous or metamorphic rocks are known to exist here, and certainly none are visible in place. The placers have been satisfactorily determined to be of glacial origin, as a result of the investigation of a number of geologists, among them glacial specialists in the Government employ.

It is evident to the miner that the debris he finds below his boxes is not all of local origin, as there are fragments of granite, gneiss, amygdaloid, greenstone and iron ore, and in the riffles one finds pieces of corundum, garnets, and, in addition, an abundance of black sand.

According to the state geologist of Indiana, Blatchley, in his report of 1902, gold was discovered in Morgan County by returned Californian miners in 1850, who observed the characteristic black sand in the ravines and began prospecting. They found gold in the tributaries of Sycamore and Lambs creeks, and some were able to recover two to three dollars per day for several weeks. Numerous fortune hunters were attracted, and the pay dirt was washed out in a short time, when the boom subsided. Since that time washing has been carried on by a few workers, with pan and rocker, in Brown and Morgan counties, with a total production, estimated in 1874, at $10,000 and since then probably doubled. The largest nugget recorded is of 132 grains, valued at $5.50. The silver content is small, a mint report of July 12, 1901, making return of 61c. for silver in 14.05 oz., $250.07 being the total amount of the return.

In 1902 we washed only ten yards of dirt, with a recovery of $2.50 in the boxes, when the water supply gave out, and with the gold pan we tested the little valley in which the work was carried on, finding nothing more to attract us. The gravel stratum above bed rock here was largely of the country rock, with little of the foreign wash. On Gold Creek, to the northeast, there were more foreign boulders, and apparently better and heavier values. All of the gold found was flat and well polished, indicating the long journey to its present resting place.

It is interesting to note that several diamonds of value have been found in this gold field. Mr. Blatchley mentions having seen eight, ranging in weight from one-eighth of a carat to four and seven-eighths carats.

The conclusion of Mr. Blatchley, in his 1902 report, was that the original home of the gold and diamonds was in the neighborhood of James Bay, in Canada, and he ends with the following, suggestive of prophecy: "It is not improbable that within the next quarter century, a new Eldorado will be discovered among the igneous rocks of this Far Northern region, which will be as rich in gold and precious stones as any heretofore known to man." The discoveries made in Ontario since that report was made seem in a measure a fulfillment of that forecast.

Alsatian Potash Production During 1920

The total production of Alsatian potash during 1920 reached 1,061,197 tons, according to statistics received from the office of the commercial attaché, Paris, and published in *Commerce Reports*. Of this amount, 450,000 tons was sold in France, 327,000 tons was exported to the United States, 117,000 tons to Belgium, and 92,000 tons to the United Kingdom.

The Copper Implements of the Copper Eskimo

Natives of Coppermine River Region, in Coronation Gulf District of Northwestern Canada, Use Copper Found Locally for Making Primitive Weapons and Tools—Fort Norman Nearest Point of Activity

BY DONALD A. CADZOW
Written for *Engineering and Mining Journal*

PREVIOUS to the advent of white men in the Western Hemisphere, gold, silver, meteoric iron, and copper were in use by certain of the aborigines for making ornaments and implements. These metals were too soft to supersede stone wholly as material for the manufacture of tools which required keen edges, but they were used extensively for ornaments, and in certain districts, particularly in Mexico, Central America, and Peru, art in metal had reached a remarkable stage.[1]

In prehistoric times copper was used more extensively than the other metals, both because of its accessibility and for the reason that neither smelting

COPPER ESKIMO IN SUMMER COSTUME. LEFT TO RIGHT, KOU, GIN, AK, KAT

nor even melting was necessary. The supply used by the Indians in the eastern part of the United States came mainly from the Lake Superior region, although small quantities were found in some of the Southern States. Archeologists have found many implements of native copper on ancient sites about the Great Lakes, but south of the Ohio River there are comparatively few, for in this region copper was generally considered too valuable to be used for utilitarian purposes; hence it was applied chiefly to the manufacture of ornaments.

ANCIENTS DID NOT TEMPER COPPER

A popular belief prevails that primitive man possessed the knowledge of tempering copper, but there is no foundation for this conclusion, as no specimens of pure copper have been found to possess greater hardness than can be produced by hammering, and there is no evidence whatever that the Indians had any knowledge of alloys. Heat, however, was sometimes employed to facilitate hammering and annealing.[2]

[1]See M. H. Saville. "The Goldsmith's Art in Ancient Mexico"; Indian Notes and Monographs, Museum of the American Indian, Heye Foundation, New York, 1920.

[2]See the article "Copper in Handbook of American Indians, pt. 1, Washington, 1907.

Many examples of beautifully worked copper have been found in South America. Copper bells have been dug up in Mexico, Honduras, and as far north as Arizona and New Mexico, but these are evidently of Mexican origin. Axes and ornaments are found in Peru and Ecuador, and displayed in our museums are many specimens made by the clever copper workers of ancient Mexico.

On the northwest coast of North America the natives used copper extensively, and in this region the possession of the metal, particularly fashioned in the form of large plates, indicated wealth or distinction.

CORONATION GULF DISTRICT RICH IN COPPER

Though most of the deposits of copper from which the North American aborigines once obtained their raw materials have been commercialized, there is still one district in which copper is known to occur in quantity, but which is so inaccessible that some time will elapse before it will be possible to transport and market the metal. This is the Coronation Gulf district of northwestern Canada. Deposits of copper were first reported in this region in 1776, when Moses Horton, the Hudson's Bay Company's governor at Fort Prince

COPPER ESKIMO WOMAN USING A ULU

of Wales, on Hudson Bay, obtained specimens of the metal from Indians living on the northwest coast of the bay, who had received it from natives farther west, together with information that there were deposits on a large river in their country. Horton, hoping the metal could be commercialized, commissioned Samuel Hearne, a young Englishman, to explore the district in which the copper had been discovered, for the purpose of determining whether the locality could be reached by ships from Hudson Bay, and if the copper existed in sufficient quantities to pay the company to mine it and ship to England.[3]

After two unsuccessful attempts, Hearne finally, with much difficulty and almost endless hardship, reached

[3]See Hearne, Samuel, "Journey From Prince of Wales Fort in Hudson's Bay to Northern Ocean," London, 1795.

TWO COPPER ESKIMO BELLES

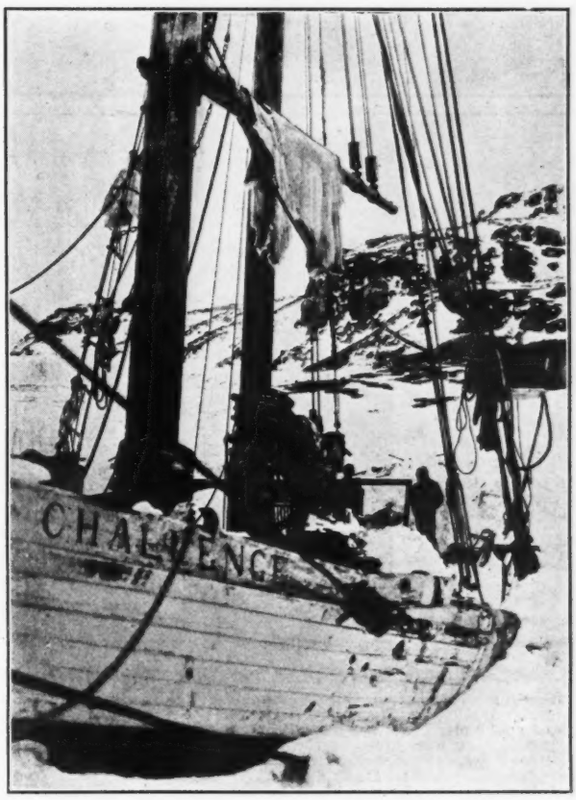
the shore of the river where the deposits were reported. Although he was not a geologist, he verified the statements of the Indians, but proved that the district where the copper occurred was too remote and difficult of access to permit profitable mining, even if ore should be found in abundance. Hearne surveyed the river and named it the Coppermine. While thus employed, the northern Indians who had accompanied him discovered and massacred a small party of Eskimo camped on the shore of the stream. These natives were undoubtedly the forefathers of the people who are now called the Copper Eskimo, or Kidnelik (Qidneliq). Hearne reported that native copper was used extensively by them in making utensils and weapons, and brought back a few specimens of their handiwork to Fort Prince of Wales, whence they were shipped to England and all trace of them was lost.

Since the time of Samuel Hearne, Coppermine River has been visited by several explorers, and the district, then sparsely occupied by northern Athabascan Indians, was later taken over by the Eskimo, who hunt far inland during the summer for caribou and return to the coast for seal in winter. They no longer fear their hereditary enemies, the Indians, who, on the advent of white traders, moved from the barrens to the timberland, where the climate is less severe and the trading stores are more accessible.

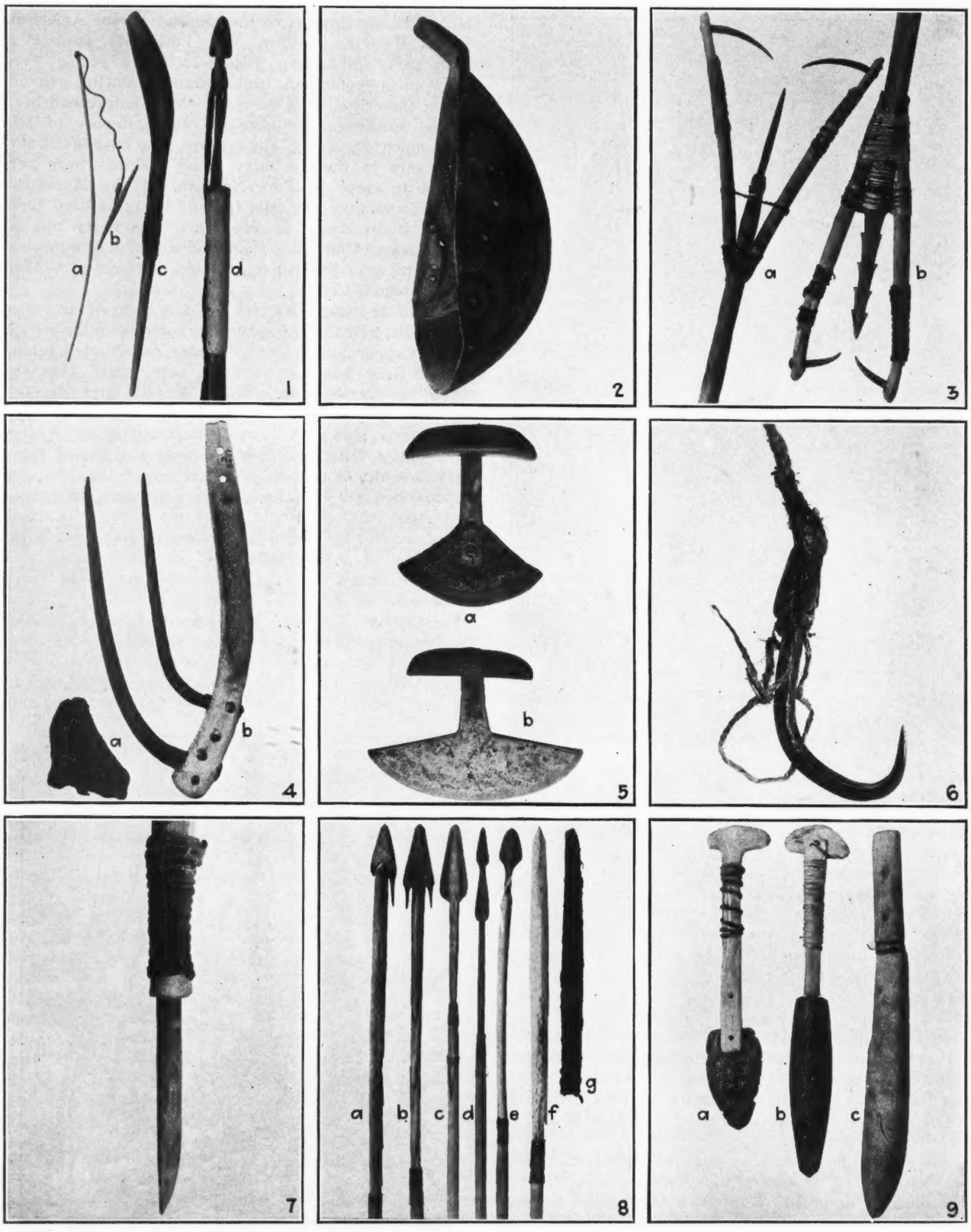
It was my good fortune while conducting an expedition into the Mackenzie River district of northwestern Canada in the interest of the Museum of the American Indian, Heye Foundation, New York City, to meet a small party of Copper Eskimo. These people were many miles from their usual summer hunting ground, and in the center of what a few years before had been hostile territory. But through the influence of two white men, prospectors and traders, who have spent several years in their country, these Eskimo were persuaded to come to Fort Norman, on the Mackenzie River, protection from the Indians being assured them by the white men. It was when this party was at Fort Norman that I met them and collected ethnological specimens, among which are numerous pieces of worked native copper.

One of the men, Katiuck by name, said he was a Pallirmuit, and that he made his home near the mouth of the Coppermine River in winter and hunted inland toward Bear Lake in summer. He stated that the native copper used in making utensils and weapons was usually picked up in the form of float, both on the western side of Victoria Island and along Coppermine River. He also said that on the island there were boulders of copper that were larger than an *iglu*, or snow house. From his description, it may be judged that some of them would weigh many tons. Katiuck also described the primitive method of copper-working. Following is a description of the more noteworthy objects gathered from the Copper Eskimo as illustrated on page 1026:

Gaff Hook (Fig. 4). The manufacture and use of the copper-pronged gaff hook was described as follows: First, a rough prong is hammered out of a small mass of float copper (Fig. 4a) with a beach pebble held in the hand. Next it is smoothed and finished by rubbing



SCHOONER "CHALLENGE" CAUGHT IN ICE ON COAST OF CORONATION GULF



NATIVE COPPER OBJECTS OF THE COPPER ESKIMO

1. Sealing equipment. (a) Bone seal indicator. (b) Peg for fastening indicator to edge of seal hole. (c) Musk ox horn spoon for rimming out seal holes and killing seals. (d) Spear with copper-tipped togglehead, squared copper foreshaft, and with copper rivets for attaching antler head to wooden shaft. 2. Musk ox horn dipper repaired with copper rivets. 3. Spear hooks, outer prongs of wood, to which tips of antler are lashed with inward or backward pointing barbs of native copper driven through them. Center prong of copper or antler. 4 (a) Mass of float copper from which piece has been cut. (b) Gaff hook with copper prongs copper-riveted to head. Head beveled for fastening to wooden shaft with copper pegs and raw sealskin strips. 5. Ulus or woman's knives. (a) Solid copper blade with wooden grip. (b) Copper blade copper-riveted to antler shank with antler grip. 6. Copper fish hook with part of attached sinew line. 7. Ice chisel. Copper blade is attached to antler head mounted on 6-ft. wooden shaft. Blade is driven into antler pith when green, which shinks, gripping serrated edge tightly. 8. Arrowheads and sheath. (a, b) Single- and double-barbed copper-tipped rankling heads. (c) Rankling head made from single strip of copper. (d) Double-tipped rankling copper head. (e) Copper-tipped spade-shaped rankling head. (f, g) Notched bone arrowhead and rawhide sheath. 9. Snow knives with copper blades, indispensable in making snow houses, and always carried.

against a large boulder. A piece of caribou antler is shaped into a head (Fig. 4b), holes are cut through it, and each prong is attached by passing one end through a hole and hammering it to a flat rivet head. The prongs are then securely wedged in place with small pieces of copper. The head is fastened to a wooden shaft which is from 15 ft. to 20 ft. long and about 1½ in. in diameter.

The gaff hook is used generally for catching the so-called trout in the streams flowing into the Arctic. These fish, which in reality are a species of salmon, weighing from three to ten pounds, enter fresh water only during the spawning season. In using the gaff the fisherman finds a shallow place in a stream where the trout are running. Standing in a cleared space, usually a gravel bar, he cautiously slips the hook into the water, prongs upward, and allows the pole to float with the current until the hook is directly behind a fish, then with a quick jerk he transfixes it, and, running up the bank, drags it out of the water. With a forward thrust he loosens his catch, kills it with a club and is ready for another.

Copper Fish Hook (Fig. 6). This represents another type of fishing tackle used by the Copper Eskimo for fishing through the ice in winter. A piece of dried fish is tied to the copper hook for bait, and the fisherman bobs it up and down in the water to attract the fish. The proximal end of the copper hook is beaten out flat to facilitate the attachment of the line, which is spliced around the shank and stitched in place with a small piece of sinew. The line is made of four strands of sinew, braided and spliced, and is kept well greased with seal-oil to make it more pliable and to prevent freezing while out of the water.

Ulus, or Woman's Knives (Fig. 5). The copper-bladed *ulu* is essentially a woman's knife, used in cutting skin for clothing. The hide is placed on a board, an incision is made with one end of the blade, and the skin cut with a forward motion of the wrist. The *ulu* is also used for carving and chopping meat and fish.

Sealing Equipment (Fig. 1). In Coronation Gulf the seal is the main source of winter food supply, and therefore the sealing harpoon (Fig. 1d) is an essential part of the equipment of every hunter among the Copper Eskimo. There are two methods of locating a seal's breathing hole in the ice: In the first, dogs are trained for the purpose, and the seal hole finder is used; this is a long slender piece of bone shaped like a walking stick, and is poked through the snow until a breathing hole is found, when the hunter places the slender bone seal indicator (Fig. 1a) in the opening, one end just below the surface of the water; the other is fastened to the edge of the hole with a pointed bone peg (Fig. 1b), attached to a sinew cord that extends from the end of the indicator to the center of the peg.

The hunter sits beside the hole with his harpoon poised ready to strike, the shaft being held in the right hand and the retrieving line in the left. When the indicator moves upward, the animal is nearing the surface of the water, and the hunter quickly drives the harpoon toggle head into the seal, at the same time throwing the shaft over his shoulder and grasping the line firmly with both hands. When the seal stops struggling the hole is rimmed with a bone pick on the proximal end of the harpoon shaft, or with a musk ox horn spoon (Fig. 1c). The seal is then dragged to the ice and killed by pushing the pointed handle of the spoon into its eye. The wound is skewered with a bone peg to prevent the loss of blood, which is used in making soup.

Arrowheads. The Copper Eskimo use three varieties of arrowheads—copper, bone, and antler. Those of copper, made either of a single piece of metal or having an antler foreshaft tipped with a copper point, are the more popular and practical. They are "rankling" heads, and are used for killing big game. The pointed dowel inserted into the shaft of the arrow is made smaller than the socket, so that when the animal is struck, the head will easily slip out of the socket and remain in the victim's flesh, where with every movement it works further toward the vitals. The bone or antler-pointed heads are usually of the same type (Fig. 8), and are employed at close quarters for dispatching wounded game, the heavy, sharp-edged, broad blade tearing a large wound in the victim, killing it instantly.

The Copper Eskimo are at present rapidly becoming semi-civilized. The Imperial Oil Co., of Canada, has brought in an oil well a short distance below Fort Norman, on the Mackenzie River. With the opening of this district, engineers will undoubtedly find some means of transporting the copper from the Coronation Gulf region. Within a few years the utilization of native copper by the Copper Eskimo for making weapons and utensils will have ceased, the white man's handy and practical materials having taken its place.

Small Tungsten Production in 1920

Not since 1902 has the United States produced so small a quantity of tungsten concentrates as in 1920, according to Frank L. Hess, of the U. S. Geological Survey. The Wolf Tongue Mining Co. and the Vasco Mining Co., of Boulder, Col., were the only American tungsten miners. They produced an equivalent of 216 short tons of ferberite ore carrying 60 per cent tungsten trioxide (WO_3).

Tungsten is most used for making high-speed tools for cutting steel, so that the demand for tungsten ore rises and falls with the steel business. In 1920 the steel business was dull, and the demand for tungsten correspondingly small. At the same time, despite the small demand, the imports were rather large for peace times, and consisted in part of cheap ore from the shallow placers of China.

Much ore was apparently shipped to this country with the expectation that a heavy duty would be imposed on it and that ores in stock would accordingly increase in value. The imports for 1920 were 1,740 long tons of ore, probably averaging 65 per cent or more tungsten trioxide (WO_3) and were equivalent to about 2,111 short tons of concentrates carrying 60 per cent WO_3. Of this quantity 1,386 short tons of 60 per cent concentrates was shipped from China and most of the rest from South America.

Besides the ore 1,997,719 lb. of tungsten and ferrotungsten was imported, equivalent to about 2,250 short tons of 60 per cent ore, and probably more than enough to supply the needs of the high-speed tool industry, so that there was added to the already large stocks in this country somewhat more than the quantity of tungsten represented by the imports of ore.

Exact figures are not at hand, but a large quantity of tungsten ore is in stock in this country, probably more than a three years' supply at the average rate of consumption before the World War.

BY THE WAY

A New Star on the Financial Horizon

We have received a hand-written business proposition, from which we make certain extracts *verbatim et literatim*. Would it interest any of our readers?

A Reasonable Proposition

The ——— Mining, Milling, Prospecting and Developing and Investment Company Unincorporated. The principals and purposes of this Company are to get together a good team of capable men ambitious to make a success of the business in hand, men that are capable Prospectors, Millmen timbermen, and generally usefull to do a bit in opening up and developing likely prospects in a new and untried ventures. In short a limited number of practical picked men, no grumblers, trouble makers, knockers, but men that can do things, and not talk to much about nothing or misrepresent anything in or out of our business, only practical minded chiefly workers and owners of stock wanted only one vote to each owner regardless of amount invested or controled no freeze out game in this deal

OPPERATIONS.

To handle properties on agency business, or commission or contract to lease, Bond. buy stake, sell or develop on contract: to mill on percentage or shuch contract or investment as desided upon in a business way to take most any kind of a contract that is straight honest and profitable.

WAGES.

Wages are to be payed only to the men actually doing the hard work. Miners mechanics, millmen and these only that are giving their entire time of regular working hours a common wage of say $5 per day for boss as well as men. And only members and owners at work or in charges untill the business has an income to pay its labor. The working man must have some way of being supported. This is not intended as a wage proposition neather is it a stock proposition only as a means of dividing dividens and eather selling an interest or digging out ore and selling that or selling a property to finance the business and buy a one drill portable drilling outfit a small Gold mill a Cleavland or Forde 72 horsepower Tank type tractor of a Type 14 Ingersoll Rand or some other good portable drill all machinery Nessary costing somewhere around $15,000. (15 thousand dollars) More and possiable less an outfit than make low grade ore profitable can be handled by about 5 men taking small space can be easily and quickly set up and moved from place to place till we are shure of the prospect then we can install a perment plant. No transfers of stock out of our circle without the consent of two-thirds majority to keep out unwelcome members.

WHO WE WANT FOR MEMBERS.

Only men that agree to be honest workers, careful in expenditures, tending to their own and the company's business and are out and willing to make a success and overcome all obsticals to find a way or make one.

STOCKS.

This company is divided up into 500 shares of stock valued at: one hundred dollars $100.00 each: and each owner has one vote and 50 shares or 1/10 is the limit to each owner, 50 shares or 1/10 to —— ——— Zion City in trust for Zion Work it is the Bible Tithe of Net Proceeds. I am not attempting to incorporate Religion into this proposition but having indorsed the Zion work and agreed to pay my Tithe I simply make it plain here that I want my God to be an equal partner in this deal. Also being a seventh day believer I demand the priveledge of observing the Sabbath (Saturday).

I might add so far I am the only one that indorses this deal and am putting my puney efforts tring to make it go. It is tedious and very slow working one man alone so if I find a decent man or two or three of them I can divide up some work with them.

OPERTUNITIES.

The field of operations of shuch a company is particaly unlimited in Canada and especialy in this undeveloped Gold belt of the Ymir Camp for with a just division of profits we need fear no strike neather a money panic as one man operating alone also with an outfit like this if this camp does not turn out good simply hitch up the tractor and move. We can endever to get in touch with capital and sell some of our properties outright or work them with them on the Fifty Fifty basis under contract sell on commission or as best suits our purpose.

Another Letter to the Editor

Dear Ed,

Being an amateur gardener, I was immediately and passionately interested by this announcement of the *Oil, Paint and Drug Reporter:*

"An exportable surplus of copper, bauxite, opium and pyrethrum flowers is said to exist in Jugoslavia."

Whether to send it to you or to the rhodium botanists of *Chemical and Metallurgical Engineering* was hard to decide, but you were finally elected because of your well-known studies in connection with bauxite.

Please tell me where to get the seeds and how to plant 'em. I think a border of flowers of zinc between copper and bauxite flowers, set with ore-i-carias and edged with flowers of sulphur, would be lovely. ALICE.

[Dear Alice—We are writing our correspondents at Trn and Crb as to where to get them. Of course, "baux" should be "box," and that makes a lovely hedge.—Ed.]

A Cousin Jack Miner's Lament

"Chap by tha name o' h'Elsworth Bennett in Tonopah," says Cap'n Dick, "sends me this 'ere poem. 'Ere's w'ot 'ee sez: 'Dear Cap'n Dick: 'Ere's a bit o' crude rhyme that I've 'eard sung aroun' tha mines in Grass Valley, w'ere I wuz muckin'. Change un any bloody way you min' to, an' if you don't want for to use 'er, thraw tha bloody thing in tha sump'. Poetry, m'son, mus' be jus' like a set o' timber—snug an' fitty, so I've put in a wedge or two, squared 'er h'up a bit, an' 'ere gaws:

There be some minin' h'experts in tha states,
Oo've studied years 'pon years to fill their pates
Full o' dips an' spurs an' h'angles,
An' h'all such bookish tangles.
Not like you nor me worked h'out h'upon h'our slates
But min' you, there's some 'igh-toned h'engineers,
'Oo've took a course in these 'ere minin' schools,
May be tried to learn but couldn't,
For I naws well they wouldn't
Naw tha trammers from tha Sutro Tunnel mules.

They'll spen' h'all day a' geekin' h'at a rock,
Tha words they'll speak to 'ee would stop a clock.
They will say h'it's h'argentifrus,
Per'aps, a bit h'aurifrus,
H'also full o' 'ornblende, glance an' poppycock.
But they doesn't naw cut-'ole from a liffer,
Nor 'ow a set o' timber should be put,
An' never seems to 'ave tha time
For to study h'out tha mine,
Nor doesn't naw tha 'angin' from tha foot.

Couldn't tell a sollar from length o' rails.
Wouldn't naw bal-dag from a keg o' nails.
An' w'ot they naws o' shovelin',
Jus' comes o' this 'ere grovelin'
With a muck-stick, shovelin' snaw, an' breakin' trails.
They mightn't naw a slick-sheet from a sheave-wheel.
Nor worked in runnin' groun' like you an' me,
But w'en thee take un forth an' back, thee'll h'admit
that h'it's a fac',
They're better h'educated chaps than we.

CONSULTATION

The Kata-Thermometer

"The student of mine ventilation and of atmospheric conditions surrounding mine workers is reading many references to 'Leonard Hill's Kata-Thermometer' as an instrument indicating these conditions. None of us have ever seen one or had its principles explained. I assume that it is some form of thermometer, and, therefore, address you with our request for a brief exposition of the present form of the instrument and of its indications."

The kata-thermometer is an instrument used to measure the cooling power of the atmosphere. It is somewhat similar to the ordinary wet and dry bulb thermometer, both in construction and operation, and has been practically applied to the ventilation problems of deep mines, particularly in South Africa. It is found in practice, according to Dr. J. A. Orenstein, that kata-thermometer readings afford a much better way of investigating actual atmospheric conditions in relation to practical problems than anything which one could possibly obtain with the anemometer or thermometer. The "kata" is easily used, and the calculations are simple.

It is best described in the words of its inventor and designer, Dr. Leonard Hill, who, writing in the *Monthly Weather Review* for December, 1920, states that:

"Wet-bulb temperatures in factories and mines are physiologically much more important than dry-bulb temperatures; so, too, the vapor-pressure reading is much more important than the relative humidity, and the velocity of movement of the air is most important of all, for on this chiefly depends cooling by convection and evaporation. The dry-bulb thermometer indicates the average effect of the temperature of the air and walls of the inclosure on itself; it does not show the cooling and evaporative power of the environment on the skin and respiratory membrane. It is a static instrument, whereas the body is dynamic, producing heat which must be lost at an equal rate.

"To measure cooling and evaporative powers I have introduced the kata-thermometer, a large-bulbed spirit thermometer of standard size and shape [British standards understood], graduated between 100 deg. and 95 deg. F.[1] The bulb is heated in hot water in a Thermos flask, until the meniscus rises into the small top of the bulb. It is then dried, suspended, and the time of cooling from 100 deg. to 95 deg. F. is taken with a stop watch in seconds. The number of seconds divided into a factor number (approximately 500, and determined for each instrument) gives the cooling power by convection and radiation on the surface of the 'kata' at approximately this temperature, in millicalories per square centimeter per second. The operation is repeated with a cotton muslin fingerstall on the bulb, and the wet 'kata' cooling power obtained, a cooling power due to evaporation, radiation, and convection.

"The difference between the two gives the evaporative cooling power. In Britain the mean dry 'kata' cooling power on the top of observatories is from 20 deg. to 25 deg. F. in July and August and about 40 deg. F. in December and January. Extensive observation shows that the dry 'kata' cooling power is about 6 in ordinary rooms occupied by sedentary workers. It certainly should not be less than 6 except under conditions of outside temperature which make it impossible to secure such a cooling power by means of fan ventilation. It is found to be as low as 4 and even 3 in factories and offices when proper attention to ventilation would easily secure readings of 6.

"When physical work is being done, the reading should be higher, say 7 or 8, or even more when labor is being performed. By keeping the cooling power in proper relation to the work done and the heat output of the worker—four times as much energy is spent by the body in heat as in doing external work—the latter can be kept from sweating, and, working with comfort and ease, he will be naturally stimulated to give greater output. . . .

"The 'kata' can be used as an anemometer, the formula connecting temperature and wind with the cooling of the dry 'kata' having been marked out in wind tunnels. . . . Renewed investigation at a low range of velocities gave the following as the more nearly correct form:

$$H/\theta = 0.12 + 0.54\sqrt{v};$$

and for velocities below 0.4 meter per second

$$H/\theta = 0.165 + 0.42\sqrt{v}.$$

(in which

H = Cooling power of air in millicalories per sq.cm. per second.

θ = Excess of 'kata' temperature over temperature of air = $36.5 - t$.

v = Velocity of wind in meters per second.)

"The wet 'kata' reading is found to be about 18 to 20 in rooms which do not feel close when sedentary work is being done. In warm moist spinning sheds and mines it may be as low as 10 to 12. The wet 'kata' reading is of great import when the temperatures approximate body temperatures, and cooling by convection and radiation becomes greatly reduced. . . .

"The 'kata' indicates cooling and evaporative power from its own surface, not from the human body. Its bulk is comparable with the body of a mouse, and is much smaller than the parts of a human body. The 'kata' readings give valuable measures of cooling and evaporating powers, but not directly measurements of the cooling and evaporative loss of the body. . . ."

To anyone interested in a more extended discussion of the kata-thermometer, an article published in the November, 1920, issue of *The Journal of the Chemical, Metallurgical & Mining Society of South Africa*, entitled, "The Kata-Thermometer and Its Practical Use in Mining," by H. J. Ireland, will be found valuable, as it gives an extended record of the experimental work leading up to the design of the instrument, and a discussion of the theoretical and practical considerations governing its use. A paper, "Scheme for Working the City Deep Mine at a Depth of 7,000 Ft.," by E. H. Clifford, published in the February, 1921, *Bulletin of the Institution of Mining and Metallurgy*, describes an application of the "kata" to mining operations at great depths, and, coupled with the discussion following in the March and April numbers of the *Bulletin*, presents an interesting and highly informative and instructive amount of data.

The consensus of opinion among those engineers and others who have made practical use of the device seems to be wholly commendatory. Mr. Clifford in his article pays tribute to Dr. Hill's work in stating that "It is to the recent researches of Dr. Leonard Hill and his associates that we owe an adequate statement of the physiological theory of ventilation."

[1]Dr. Hill has stated that the mean of 100 deg. and 95 deg. F. was 36.5 deg. C., which could be taken as the skin temperature; hence the reason for taking the range indicated.

HANDY KNOWLEDGE

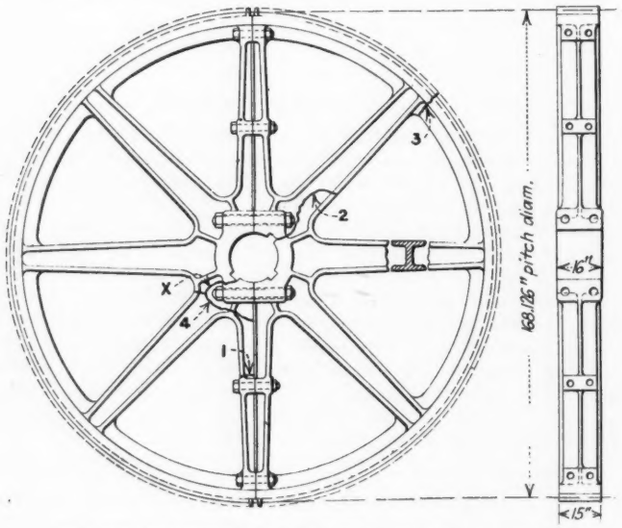
Repairing a Gold Dredge Bull Gear

BY C. M. ROMANOWITZ

Written for *Engineering and Mining Journal*

On the night of April 5, 1921, at 10:45 o'clock, the Marysville dredge No. 5, operating at Marigold, Cal., was shut down, owing to a serious break of the bull gear on the starboard side. The cause of the trouble was a break of the intermediate shaft on the port side, which threw all the load on the starboard gear, which was weak because it had been poorly repaired previously. The gear apparently broke first in the old weld in the hub as shown at *x* in Fig. 1, then breaking at the other three points also designated.

The gear is of cast steel, approximately 14 ft. 2 in. in diameter, 15-in. face, 16 in. through the hub, with 192 cut teeth of 2¾-in. pitch. It is cast in halves and bolted together through the hub with four 2¾-in. rod



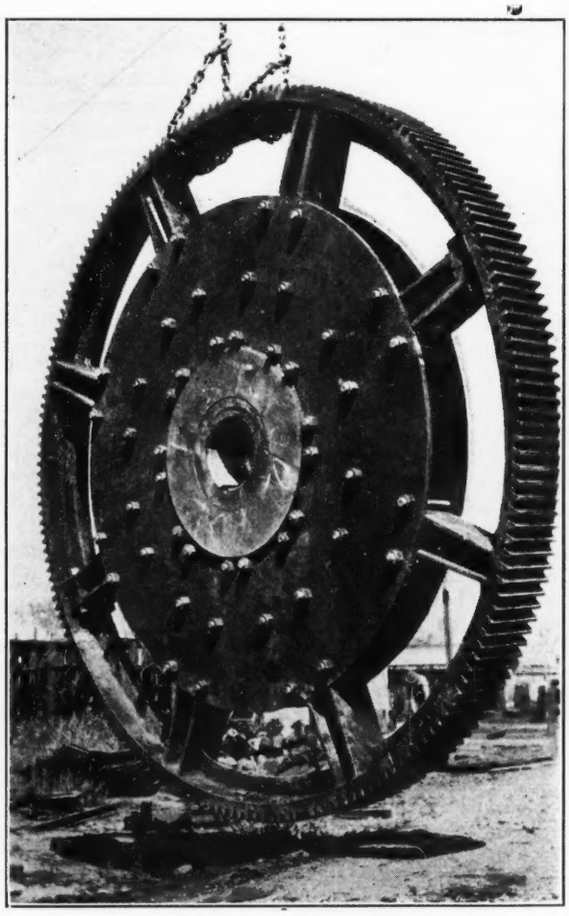
THE GEAR BROKE FIRST AT *X*, THEN AT OTHER POINTS AS SHOWN

bolts and eight 2¼-in. bolts through the split spokes, and weighs 18,190 lb.

As there was no spare gear on hand, and as the gear was not interchangeable with the gears on the other 18-cu.ft. dredges in operation, the situation was serious, owing to the probable shut-down of from six to eight weeks before a new gear could be supplied. It was therefore necessary to try to repair the broken gear, even though it looked almost impossible. It was without doubt the largest electric welding job ever tried on a gold dredge.

The four pieces of the broken gear were taken to the dredge repair shops at Marigold and there arranged for the welding. Owing to the fact that the gear had been electrically welded before, and had failed at the welded part, there was not much confidence that the electric welding would do the work properly. However, upon close examination of the break, it was easily seen that the original welding had been poorly done. This was owing to the fact that the repair had been made by a man who had had no experience in the heavy work and who was forced to work almost continuously until the job was completed. The weld clearly showed that the work had been slighted toward the end, and that the man had not had sufficient experience.

Through the kindness of the Natomas Company of California, that company's large welding apparatus, used on the dredges at Natoma, was taken to Marigold to do the work. Two welders having considerable experience in heavy welding were put on the work. The men worked twelve-hour shifts until the job was completed,



THE DREDGE BULL GEAR REPAIRED

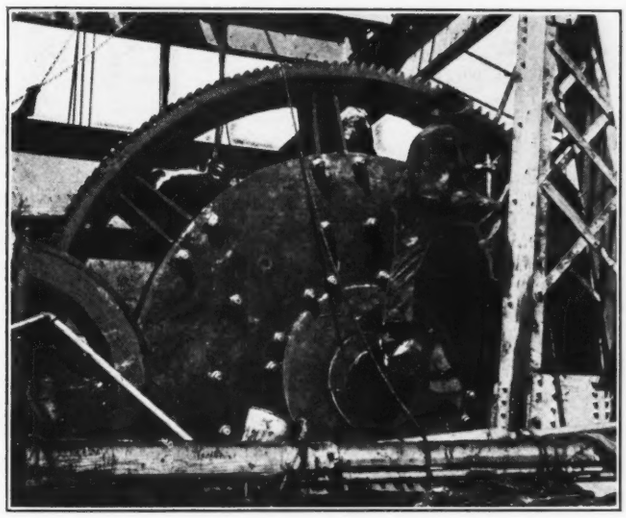
taking approximately eight double shifts and using over 400 lb. of welding rods.

In the meantime, on the morning of April 9, at 9 a.m., two plates, 1⅜ in thick by 126 in. wide and 272 in. long, were located at the Ralston Iron Works. These were ordered, cut in halves, 126 x 136 in., loaded on cars and left San Francisco at 3 p.m. the same day, arriving in Marysville April 10, and were hauled out to Marigold the morning of April 11. Two of the plates were cut to 10 ft. 6 in. outside diameter and 26 in. inside diameter and from the other two were cut two additional plates of 48 in. outside diameter and 26 in. inside diameter.

The welded gear and four plates were then hauled to the plant of the Yuba Manufacturing Co. at Marysville

on April 14, arriving at 4 p.m. At 6 p.m. the gear was set on the mill and the machining started. It was necessary to machine the hubs to 26½ in. diameter in order to shrink the reinforcing plates on, and in doing this it was necessary also to machine through the boxes for the four 2¾-in. bolts, leaving the holes exposed, which were filled with rods and electrically welded. The hubs were first rough finished, and after the welding was done the machining was completed to the necessary diameter. Also, to permit the plates to be put on, it was necessary to turn the outside faces of the spokes about ¾ in. deep out to 10 ft. 6 in. diameter. As the spokes were made of tough steel, considerable time was saved in machining the second side by burning with an acetylene torch the excess material of the bosses on the hub and the spokes, leaving just a small amount of machining to be done. The bore of the gear was not true, and it was necessary to add metal and to re-bore to the proper diameter. The machining of one side and boring took until 3 p.m., April 17. Then by the method of cutting excess material just described there was saved about thirty-two working hours on the opposite side, so that the gear was taken off the mill on April 19.

The plates were next bored on this mill, which is capable of turning to a diameter of 16 ft. The finished



INSTALLING THE BULL GEAR

plates were then heated, one at a time, and shrunk on the gear. In heating the large plates, care was taken so to heat them with the oil burners as to make them dish outward. One was shrunk on each side, so that the outside diameter of each plate was clear of the spokes. Both plates were afterward drawn together with forty-eight 2-in. rod bolts, which were so placed as to give good bearing against the spokes. As can be seen in the photographs, the plates of smaller diameter were not bolted, but were electrically welded to the larger ones at the outside diameter. The gear as repaired weighed 23,980 lb.

The work was finished at the Yuba plant at 1:30 p.m., April 20, and hauled to the dredge repair shop at Marigold and to the bank of the dredge about 10 p.m. that night. At 1 a.m., April 21, the gear was placed aboard the dredge. Considerable difficulty was encountered on the dredge owing to the gear being originally split so that it could be conveniently installed. To put the gear on, it was necessary to disconnect the bucket line, tear down part of the hopper, and lift the upper tumbler, shaft and port gear out of the bearings and slide them to one side to let the repaired gear clear the starboard truss until put on the shaft. Delay was also caused owing to limited head room on the crane. However, the crew overcame these hindrances and had the dredge ready to run at 1:30 p.m., April 21.

The lost time due to this break was 374 hours 45 minutes, or 15 days, 14 hours 45 minutes. The repairs were made under the direction of Gerald H. Hutton and Gregg Hanson, of the Marigold Store & Construction Co.

M. L. Summers, of the Yuba Consolidated Goldfields, and L. D. Hopfield, of the Natomas Company of California, greatly assisted Mr. Hutton in the welding job by their experience and advice. The close co-operation among the gold dredge superintendents of California is shown by Mr. Hopfield's loaning of the Natomas welding outfit for the job, which was too large for the welding equipment immediately available.

The interesting feature of this repair job is that it establishes a further limit to the possibilities of large repair work. This job appeared to be almost impracticable, and it required courage to undertake it. The question now is, what is the limit of electric welding in repair jobs on dredges? Electric welding has revolutionized dredge repair work, and the job just described is a record in such work.

A Two-Minute Qualitative Test for Lead

BY E. C. D. MARRIAGE

Written for *Engineering and Mining Journal*

A rapid and reliable test for the presence of lead in an ore should be a part of the handy knowledge of everyone who may have contact with the ores of this metal. A method that is more or less in common use in the West is as follows:

Place a portion of the finely ground ore, approximately 0.5 gram, in a small beaker, drop one or two drops of concentrated nitric acid directly upon the ore, allow to act for a moment, then dilute with about 20 c.c. of cold water, and to the resultant solution add about 0.1 gram of finely powdered potassium iodide. A brilliant yellow precipitate of lead iodide will indicate the presence of lead.

Other minerals may be present in the sample which have the power to liberate iodine, masking the color of the precipitate if the lead content be less than one-tenth of 1 per cent. Copper and a high percentage of iron are the chief source of interference. An excess of nitric acid will have the same effect, and for this reason not more than two drops should be added. The dull yellowish-brown color of the iodine is not likely to be confused with the brilliancy of the lead precipitate.

The test is distinctly reliable, and in the hands of a skilled operator will indicate the presence of the metal when as low as two-tenths of 1 per cent.

Mine Locomotive Haulage

According to Gerard B. Rosenblatt, the lightest permissible weight of rail that can be used in the operation of electrical locomotives underground is as follows: 4-ton locomotive, 12-lb. rail; 6-ton locomotive, 16-lb. rail; 8-ton locomotive, 20-lb. rail; 10-ton locomotive, 25-lb. rail; 15-ton locomotive, 40-lb. rail.

The mine-track gage with respect to the heaviest locomotive available for the gage of track is as follows: 18-in. gage, 4-ton locomotive; 24-in. gage, 8-ton locomotive; 36-in. gage, 20-ton locomotive.

THE PETROLEUM INDUSTRY

The Mesopotamian Oil Controversy

BY HENRY C. MORRIS
Written for *Engineering and Mining Journal*

THE MESOPOTAMIAN oil controversy between the United States and Great Britain has reached the point at which the liquid might be almost said to belie its nature and to have become an irritant instead of a lubricant. This is so contrary to the nature of the fluid itself, that the good faith and good sense of the governments and the people of the two countries should unite, to restore oil to one of its proper functions of lubrication, and as suggested by Sydney Brooks in the March number of the *Fortnightly Review*, the two governments should take counsel together, lay their cards on the table, and by a timely discussion and the widest publication of their oil policies and requirements do everything possible to moderate feeling and to restore perspective.

Ignorance concerning the facts, or concealment of them, inadvertent or willful misunderstanding of opposing statements, or unwarranted animus, only prolongs the dispute, confuses the argument, and adds bitterness to what should be a friendly and businesslike discussion.

DIPLOMATIC EXCHANGES NOT PRODUCTIVE OF RESULTS

The present divergence of opinion regarding Mesopotamian oil concessions, particularly as between the United States and Great Britain, has been argued publicly for months by official correspondence and by the interested nationals of both countries, without, so far as the public can learn, any approach to a definitive settlement. The rational, statesmanlike method of adjustment necessitates a free, frank, and open discussion between representatives of the two countries, with full authority to agree on a plan of co-operation that will prevent further controversy and complications. Substantial progress has been made by the exchange of official notes, but this process is painfully slow and unnecessarily delays arriving at an amicable adjustment of the controversy. It is appropriate, in view of the present misunderstanding of the facts, to detail the basis of the respective claims and to submit the brief to the bar of public opinion, particularly in the two countries chiefly concerned.

HISTORY OF CONCESSIONS

The British claims to petroleum concessions have the following history:

In 1888 a representative of the Deutsche Bank obtained a concession, by imperial firman, to build a railroad from Ismid east to Angora, which was completed in 1892. This is known as the Anatolian Railway Concession. Subsequent concessions extended the right of the Anatolian railway company from Eskishera southeast to Konia; and in 1903 another concession, for ninety-nine years, covered a right of way from Konia to Bagdad and Basra, via Adana and Mosul. Article XX of the Anatolian Railway Convention of 1888 provided, in its opening paragraph, that the concessionaire could exploit mines which it might discover in a zone extending for twenty kilometers on each side of the center of the right of way if it conformed to the laws and regulations relating to such concessions. It was expressly stated, however, that this permit was not to be construed as a monopoly. Article XXII of the Bagdad Convention, or concession, granted similar privileges for the Konia-Bagdad right of way, but for twice the lateral extent of the former concession; that is, for forty kilometers on each side of the center of the right of way.

RIGHTS ACQUIRED BY ANATOLIAN RAILWAY

In 1904, the Anatolian Railway obtained, from the Ministry of the Civil List, the right to explore for oil wells in the vilayets of Mosul and Bagdad, which rights were granted to the civil list by the Sultan in firmans of 1889, 1898, and 1902. These firmans granted all oil wells discovered or to be discovered in the whole territory of the two vilayets.

The rights granted to the Anatolian Railway under its convention of 1904 with the Ministry of the civil list expressly stipulated that preliminary borings or explorations must be carried out within one year. These preliminary investigations were not made, and the Anatolian Railway was therefore officially notified of the forfeiture of its rights because of non-compliance with the provisions of the convention.

The petroleum rights in the vilayets of Mosul and Bagdad were transferred, in 1908, from the Ministry of the Civil List to the Ministry of Finance. In 1912 the Turkish Petroleum Co. was formed, as the result of a British-German diplomatic agreement, to take over the oil rights alleged to be held by the Deutsche Bank and its subsidiaries. It should be remembered, in this connection, that the Anatolian Railway had already forfeited its rights because of non-compliance with the terms of its concession and had been officially notified of the fact.

TURKISH PROMISES NOT HONORED

The Turkish Petroleum Co. evidently did not consider its acquisition of rights any too secure, for in 1914 it alleges that the Turkish Minister of Finance promised the company a contract, or concession, covering the oil rights in Mosul and Bagdad. Whatever the Grand Vizier is alleged to have promised or did promise in 1914 was never sanctioned by the Turkish Parliament, which sanction was necessary under the Turkish law; nor were the conditions of the alleged concession definitely

settled. In other words, the alleged contract was merely the personal statement of a Turkish official which was not legally binding on the Turkish government or on the successor of the Turkish government in Mesopotamia.

The ambassadors of Great Britain, Germany, and Turkey were engaged in negotiations regarding this concession or contract at the outbreak of the World War, at which time the railway was in operation from Konia, with one or two breaks, to somewhat beyond the crossing of the Euphrates River east of Birejik, or east to the Gulf of Alexandretta. Such, in brief, is the history of the so-called Turkish Concessions, on which more detailed light is shed by an article in the *Quarterly Review* (London, 1917), in Volume 228, under the title of "The Bagdad Railway Negotiations."

British Prime Minister Declines to Disclose Facts and Papers

Requests were made in the British House of Commons in June and July, 1920, for all facts and papers covering the petroleum claims in Mesopotamia. On June 28, 1920, the Prime Minister stated that his reasons for refusing to honor these requests were that "It is not possible to say what claims, based on grants by the Turkish government, may be put forward in the various mandated territories." If the alleged contracts were valid, or were in full legal force and effect at the outbreak of the war, why not produce them?

On Dec. 15, 1920, the Prime Minister, addressing the House of Commons, said:

We have shown perfectly clearly that if there is a rich deposit of that kind (oil) which requires to be examined —and it has not been examined up to the present time— we have made it quite clear that if there is a rich deposit of that kind, it is for the benefit, not merely of the British Empire, but for the whole world, and that we shall hold the balance merely between the nations of the world. But the mandate means that it is under British advice.

Lord Robert Cecil, in a letter to the London *Times* under date of June 24, 1920, went even further, saying:

Unless the mandates effectively entitle the natives to protection and forbid improper employment of the resources of the mandated territory, the advisory powers of the League will be a farce, and we shall be back in the bad old days of conquest and exploitation which it was the chief object of the mandate system to destroy.

When the Turkish treaty was being drafted by the representatives of the Allied powers, the President of the United States made public certain statements contained in a note to the Allied governments, to which the Supreme Council at San Remo replied in part as follows:

The economic provisions of the Turkish treaty are in general harmony with those approved in the treaty with the enemy powers with particular regard to concessions in the former Turkish Empire. These were, as is well known, not infrequently obtained by dubious means and under conditions inconsistent with the best development of the areas where they were located. The eventual right to cancel concessions has only been provided for in territories which are to be placed under the tutelage of the principal Allied forces. It has been felt unfair to saddle these new states with burdens which they had no voice in incurring.

Finally, the Allied governments take this opportunity of assuring the United States Government that the Allied governments have in no way sought by the territorial changes and arrangements provided for in the Turkish treaty to place their corporations or citizens in a privileged position as compared with American citizens and corporations.

Secretary Colby's note to Lord Curzon under date of Nov. 20, 1920, said in part:

This Government welcomes your pledges to the effect that the natural resources of Mesopotamia are to be secured to the people of Mesopotamia and to the future Arab state to be established in that region, and that it is the purpose of the British government, fully alive to its obligations as a temporary occupant, not only to secure those resources to the Mesopotamia state, but also its absolute freedom of action in control thereof, and in particular that it is far from the intention of the mandatory power to establish any kind of monopoly or preferred position in its own interests.

Another significant paragraph of the Colby note says:

I need hardly refer again to the fact that the Government of the United States has consistently urged that it is of the utmost importance to the future peace of the world that alien territory transferred as a result of the war with the Central Powers should be held and administered in such a way as to assure equal treatment to the commerce and to the citizens of all nations.

And again our Secretary of State says:

. . . I might observe that such information as this Government has received indicates that, prior to the war, the Turkish Petroleum Co., to make specific reference, possessed in Mesopotamia no rights to petroleum concessions or to the exploitation of oil; and in view of your assurance that it is not the intention of the mandatory power to establish on its own behalf any kind of monopoly, I am at some loss to understand how to construe the provisions of the San Remo Agreement that any private petroleum company which may develop the Mesopotamian oil fields "shall be under permanent British control."

In a communication to the London *Times* under date of Oct. 21, 1920, A. Berriedale Keith, an eminent British authority on constitutional law, of the University of Edinburgh, said in part:

The report that the State Department at Washington is far from favorably impressed with the British and French attitude on the question of Mesopotamian oil suggests an interesting point as to the meaning of Article XXII of the Covenant of the League of Nations. . . . I am wholly unable to understand how the obligations imposed by the League Covenant are to be reconciled with the agreement regarding petroleum concluded on April 25 at San Remo between Mr. Lloyd George and M. Millerand, which appears to me to be open to all the criticisms adduced in the case of Nauru, while the reply made by Lord Milner is inapplicable. For the British government itself to develop the Mesopotamian oil field appears to be wholly incompatible with the obligations of a mandatory state, as opposed to a state exercising a veiled annexation, and the manifest duty of the mandatory appears to be to advise the Mesopotamian administration that in the grant of concessions for oil strict impartiality must be observed by the nationals of the state and members of the League. If it is contended that the British and French governments are entitled to make use of the rights flowing to them from former Turkish concessions, the reply is simple; by agreeing to the terms of the League Covenant they have precluded themselves from exercising in specie these rights when in conflict with the principles and terms of the Covenant, and have only a right to be reimbursed by the Mesopotamian state the amount of any expenditures actually incurred by them heretofore under the terms of the concessions.

The question is one of far more than theoretic interest; the deplorable waste of British and Indian lives, apart from the enormous expenditures involved in the pacification of Mesopotamia, is more unjustifiable if it is incurred in the pursuit of a policy which persisted in will endanger

Anglo-American relations and ruin all belief in the honesty of the mandatory system.

In explanation of the above quotation, particularly the reference to the British government itself developing Mesopotamian oil fields, it must be understood that the British government really controls the Turkish Petroleum Co., through the Anglo-Persian interest in the latter. It is known of course that the British government holds two-thirds of the capital stock of the Anglo-Persian Oil Co., and that the government representative on the board of directors of this company can negative any action of the board.

I submit therefore that the Mesopotamian petroleum concessions were forfeited ten years before the war, and that if any partial rights which it is claimed were acquired prior to the World War are regarded by Great Britain as a monopoly which, ". . . shall be under permanent British control," they are a violation of the statement of the Supreme Council of the League of Nations that the Allied governments have in no way sought to place the corporations or citizens in a privileged condition as compared with American citizens or corporations.

To quote Dr. John H. Latané, professor of diplomacy at John Hopkins University:

> The San Remo Agreement should not be permitted to stand, and if Great Britain wishes to remain on cordial terms with the United States she must back down from a position which is wholly untenable.

Further to prolong the arguments, and thus endanger the friendship between Britain and America in order to sustain a ministry before its people and its commercial interests, or, for the sake of an economic advantage based on dubious antecedents, to uphold an invalid claim, constitutes an unforgivable reversion to the short-sighted, selfish, economic imperialism which was the principal cause of the World War.

Let us show our mutual good faith by our mutual willingness to come speedily to a just and amicable settlement of this unnatural cause of international irritation.

Petroleum in the Salta-Jujuy District, Argentina*

BY ARTHUR H. REDFIELD

The Salta-Jujuy district of northern Argentina is a triangular area, with sides about 100 miles long, lying 800 to 900 miles northwest of Buenos Aires, adjoining the frontier of Bolivia, with whose fields it is continuous. Its area contains about 5,000 square miles, of which 250 square miles contain evidences of petroleum, but of which less than one square mile has been tested, with varying results.

Oil occurs in the red shales and sandstones of the petroliferous formation, placed by Brackebusch and Steinmann in the Lower Cretaceous, but considered by Bonarelli to extend into the Tertiary. The latter divides the petroliferous formation into four groups: (a) The lower sandstones, 6,600-8,200 ft. thick; (b) the limestone-dolomite horizon, 131 ft. thick; (c) the upper sandstones, 970 ft. thick; and (d) the Sub-Andine Tertiary (?), 8,200 ft. in thickness. All are probably of marine origin. The oil, occurring principally in the lower sandstones and the limestones, is believed to exist here in secondary deposits, formed in the underlying Devonian. Moderate folding and overthrust faulting are discernible in the Salta-Jujuy district. Eight anticlines are observed in the petroliferous formation.

Numerous oil seepages occur, as at Loma de Ipaguazu, Aguas Calientes, Quebrada de Iquira, Zanga Honda, Sierra del Alto, Rio Chico, Vado Hondo, and Rio Colorado. The Lower Traissic (?) limestones of the Upper Salado River are charged with petroleum. Sulphur springs are numerous.

The Salta-Jujuy district was studied in 1882 by Brackebusch, and in 1888 by Dr. über, for the Companiá Mendocina de Petróleo. This company in 1910-11 drilled four wells at El Garrapatal, without result. The Companiá "El Petróleo Argentino" drilled at the same time Laguna de la Brea, Jujuy, without commercial success. Senor Tobar drilled four shallow wells at Quebrada de Galarce without obtaining oil in any quantity. A well drilled by the Argentine government at Capiazuti was abandoned in 1916 "for economic reasons."

Concessions, as granting exclusive mining rights or special privileges over large areas, do not exist in the Mendoza-Neuquén district. The term concession is applied to the permission granted by the national or a provincial government to prospect or develop a given area. A concession may be granted to anyone, citizen or alien, who complies with the official formalities. The discoverer of a mineral deposit has prior rights over all other applicants. All mines are owned by the provincial governments, or, in national territories, by the national government.

Foreigners in Argentina enjoy all the civil rights of the citizen, and may do business or trade without adopting Argentine citizenship or paying special taxes. Citizenship may be acquired after two years' residence. Neither the mining code nor the law and regulations of mining make any distinction between nationals and foreigners for obtaining or developing concessions. A bill has been submitted to the Argentine Congress, however, declaring all petroleum wells to be national property, to be prospected or exploited by the national government.

*U. S. Geological Survey, Section of Foreign Mineral Resources.

The Dover Oil Field, Ontario

SPECIAL CORRESPONDENCE

Work by several companies in the Dover oil field, in western Ontario, is making steady progress. The Petrol Oil & Gas Co. has seven tank cars of oil ready for shipment, and its production of both oil and gas is reported to be satisfactory. The Vacuum Gas & Oil Co.'s well is being connected with the Southern Pipe Line Co.'s gas mains. The Ajax Oil & Gas Co. is holding oil for shipment, pumping from five completed wells, and will test the different oil horizons penetrated in the shallow drilling.

The Eureka company is planning exploration of the Niagara and Guelph geological sands between 1,300 and 1,400 ft. deep. The Universal experienced some trouble with that company's first well in setting the 2,900 ft. of 6⅝-in. casing on the top of the oil and gas sands, but is now making satisfactory progress. The Peninsular, a new operator in the shallow field, adjoining the Ajax, has two producing wells and is drilling three adjacent leases.

Book Reviews

Geology of the British Empire. By F. R. C. Reed. Cloth; 5½ x 8½; pp. 480. Edward Arnold, London; 1921. Longmans, Green & Co., New York. Price, $14.

This is a rather curious development of the "political and commercial geology" trend. It is political geology divorced from the commercial geology. The treatment is purely from the geologic point of view, and although economic geology has its place in the presentation, it is a very subordinate one. The emphasis is mainly on the stratigraphic structure, volcanic and tectonic features, and even paleontology occupies a not unimportant place. Yet only British territory is included. For example, the book begins by describing the geology of the Rock of Gibraltar, passes thence to the Maltese Islands, thence to Cyprus, and from there to Egypt and the Anglo-Egyptian Sudan.

Such Mediterranean lands as do not lie under the British flag are geologically non-existent to the reader who voyages in fancy along with this book. Under "The West Indies" we read about the British islands, British Honduras, and British Guiana, and it is curious to find that the only geology of China is that of Hongkong. The treatment is consistent to its plan, and quite up to date. The geology of the "Mandatory Regions" receives due consideration, including Mesopotamia and Palestine.

We are used to seeing pure geology treated from the viewpoint of natural geological divisions, or at the most of natural geographical divisions, although, to be sure, the study of the geology of the United States is confined to our borders, and our numerous state surveys have similarly respected political boundaries. But hitherto we have had, for example, only the geological surveys of Canada, or of Australia, and so on, and they represent in each case single geographic provinces. To pick the rocks in the oceans of the world that are British for special description of their geology is somewhat startling, and indicates plainly the nationalistic or imperialistic idea. Therefore, the underlying idea is economic; for science knows no political boundaries. And this furnishes some strength to one definition that has been given of economic geology — "All geology is economic geology." In this book the underlying elements of pure geology are plainly put forward as a basis for an understanding of the necessary treatment and development of British territory, although no deductions to that effect are drawn.

As a textbook or reference book the volume seems admirable, showing thorough reading, great power of concentration, and clear presentation. For any one region it will simply provide an outline of the most salient features, for which the reader desirous of more precise information will proceed to the local authorities listed in the copious bibliographies. J. E. S.

Handbook of Metallurgy. Vol. 1 (Copper, Lead, Silver, Gold). By Dr. Carl Schnabel; translated by Henry Louis. Third edition. Cloth; 6 x 9; pp. 1,171. Macmillan & Co., London: The Macmillan Co., New York. Price, $13.50.

Since 1894, when the first edition of Dr. Schnabel's treatise on metallurgy was published, this book has rightly been considered a classic. Successive editions appeared in English in 1898, in German in 1902, and in English in 1904. The present volume is a revision of the second English edition by Dr. Louis, the translator, Dr. Schnabel having died, and retains the form of the earlier book with some of the older matter replaced with descriptions of more recent processes and equipment. The subject of copper occupies 387 pages; lead, 216; silver, 331; and gold, 198. It was the intention of Dr. Louis to publish this book six or seven years ago; most of the material was ready for the printer in 1914 and much of it was in type at that time. When the war broke out, publication had to be delayed, and not until this year did the book finally appear.

No book on metallurgy covers the ground so thoroughly as this volume. Most of us in America are accustomed to reading chiefly of American practice as presented by Hofman, Peters, Ingalls, and others, but here processes used all over the world are described in considerable detail, though European practice is given most prominence. The book will be particularly valuable in our own library for replying to inquirers about equipment and processes known only to us by name or not at all. Metallurgists may find the information given about foreign operations suggestive as a solution of some of their own difficulties. For example, at one American copper smelter, a method of selective converting was recently devised to segregate the small percentage of precious metals which occurred in the white metal produced at that plant. The process developed was practically the same as that used in some other parts of the world, and no doubt much helpful information could have been gained had such a reference book as the one under review been handy.

To American metallurgists who are looking for a good treatise on current practice, the book will be a big disappointment, for practically nothing which has happened in the last eight or ten years—and a great deal has happened—is mentioned. As a consequence many of the statements made are no longer true. The section devoted to copper, for example, states that water-jacketed blast furnaces are usually constructed with movable forehearths; that "where an ample water supply is available it is best to granulate the slag. . . as is done at Great Falls, and at the Parrot smelter at Butte"; that at Anaconda there is a reverberatory furnace which smelts 253 tons in twenty-four hours, using 1 ton of coal for 4.25 tons of charge; that at Dollar Bay, Michigan, "mineral containing about 60 per cent of copper is treated, over 41,000 tons having been treated in the year 1905-6." Practically nothing is said about the hydrometallurgy of copper; electrical precipitation of solutions of copper derived from ores is not mentioned as a commercial process; basic converting receives a brief paragraph; and three lines are devoted to pulverized-coal firing. Pyritic smelting is divided into two types, one being the "true" type in which no fuel whatever is used and which has come into use in only a "few instances," such as at "Tilt Cove in Newfoundland, Mount Lyell in Tasmania, at the Mammoth Copper Co., Kenneth, Cal., and at Ducktown, Tenn." Chalcopyrite is said to be the mineral source of most of the world's copper, although native copper "occurs in large quantities on Lake Superior in the State of Michigan, and at Santa Rita in New Mexico."

In discussing the metallurgy of lead, nothing is said of the Newnam ore hearth, and those parts devoted to roasting in shaft furnaces, to the charging of blast furnaces, and to a description of blast roasting equipment are decidedly incomplete when judged by present day practice. The only reference to the Cottrell process is the sentence, "Electrical methods of fume precipitation have also been tried, but have not yet passed into current practice." The sections on gold and silver contain fewer omissions and inaccuracies due to tardy publication, for improvements in practice have not been so radical. Also, those sections were apparently prepared a year or two later than the other matter in the book. Omission of such improvements as the Crowe process, is, however, noticeable.

The advisability of publishing this book without bringing it up to date is open to question, as is also the enthusiasm of the publishers, who, in circularizing us for an order, stated, "It includes every important new process that has been developed in the English-speaking world in the past dozen years." It is to be hoped that the second volume will have the benefit of a complete revision in the light of present practice. This second volume is to be devoted to the other metals not covered in the first, chiefly zinc, tin, quicksilver, nickel, and antimony presumably, and provides an opportunity to issue a most valuable treatise which will stand practically alone in the field. E. H. R.

Petroleum—A "Summary of Report of the Federal Trade Commission on the Pacific Coast Petroleum Industry, Part I," has been issued. This report was prepared in response to a resolution introduced by Senator Poindexter and passed July 29, 1919, and covers production, ownership, and profits of the Pacific Coast petroleum industry. Copies may be obtained on request to the Federal Trade Commission, Washington, D. C.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Report on Industrial Waste Blames Capital and Labor

Plan for National Leadership in Eliminating Waste Outlined and Public Support Invoked

Waste in industrial processes is causing enormous annual losses to the nation, declares the report of the American Engineering Council's Committee on Elimination of Waste in Industry, made public at the recent meeting of the council's executive board in St. Louis, Mo. "Over 50 per cent of the responsibility for these wastes," the report says, "can be placed at the door of management and less than 25 per cent at the door of labor."

The investigation found that the margin of unemployment mounts to more than a million men, that billions of dollars are tied up in idle equipment, that high labor turnover is a rough index of one of the commonest wastes, and that the waste of time and energy and money through duplications in estimates and bids in the building trades runs into millions annually.

Both employer and employee restrict output, it was found. Both capital and labor are blamed for existing abuses, but the annual losses through waste by conflicts between them is much less than popularly supposed. An elaborate plan of nation-wide co-operation of the Government, the public, trade associations, the industries, labor, bankers and engineers is outlined.

The full report of the committee comprises 125,000 words and deals with the deep-seated causes of waste. It does not consider "the present business crises, due in part to world-wide waste and extravagance caused by the war," as an excuse for transitory experiments, but as an opportunity to point out the need for permanent reform.

The findings are characterized as not exceptional, and American industry as a whole is said to suffer from the same defects as those found in the industries studied. The report states further, in part:

"The average method of management is far behind standards which have demonstrated their practical value; billions of dollars are tied up in idle equipment, and there is a large additional waste through maintenance and depreciation charges. Both employers and employees restrict output, the former usually by limiting the total output of an industry, the latter by limiting the rate of speed of output of individual workmen.

"Preventable diseases, accidents, and death cause an annual economic loss in this country of over $3,000,000,000. It is possible, by using methods already perfected, to reduce deaths and serious accidents in American industry by at least 75 per cent."

The committee offers recommendations for the elimination of waste in production and outlines the following proposed program of governmental assistance:

"A National Industrial Information Service should be established to furnish more timely, regular, and complete information covering current production and consumption and stocks of commodity; a National Statistical Service should be established covering employment requirements; a national policy regarding public health should be fostered and encouraged; the material program for industrial rehabilitation should be encouraged and should offer opportunities for education and placement to those having physical defects as well as those handicapped because of industrial accidents; a nation-wide program of industrial standardization should be encouraged in conjunction with industrial interests; the Government should recognize the necessity for a revision of such Federal laws as interfere with stabilization of industry; a body of principles should be accepted which could be developed for the adjustment and settlement of labor disputes."

The report also says:

"Public support for the movement to wipe out waste in industry should be had. Managements should improve organization, reduce high labor turnover; improve relationship with employees; maintain inspection control-maintenance of plant and equipment; coordinate quantity and quality requirements.

"Organized labor should develop a policy for increasing output; the attitude of opposition or indifference to proper standards for production should be changed and labor should show a frank and aggressive insistence on proper standards for production; give a common-sense scrutiny to the bases for wages, and modify certain union rules; individual workers should realize their responsibilities for waste resulting from ill health and disregard of safety measures.

"The banking interests should specially encourage the stabilization of industry."

The waste of idle material in large inventories of raw and finished materials is very large. Unbalanced production also results in a very large material idleness. Very large waste is said to exist through plant idleness.

The new joint home of the Institution of Mining and Metallurgy and the Institution of Mining Engineers is Cleveland House, 225 City Road, London, E. C.

John Fritz Medal for 1921 Taken to Hadfield by American Delegation

To express the obligation which the world owes to the engineers of Great Britain for the part they played in winning the war, the organized engineers of America are sending a mission to London this summer. This mission of engineers representing the so-called Founder Societies will deliver the John Fritz Medal to Sir Robert Hadfield at the opening meeting of the British Institution of Civil Engineers on June 29.

The inability of Sir Robert to come to the United States to receive the medal which was awarded him in January, 1921, moved the trustees of the board to make the ceremony of presentation in England the occasion for an international expression of appreciation by the engineers of the United States to the engineers of Great Britain.

The deputation to England will consist of a representative of each of the four Founder Societies represented on the John Fritz Medal Board of Award as follows:

Charles T. Main, of Boston, the American Society of Civil Engineers; Colonel Arthur S. Dwight, of New York, the American Institute of Mining and Metallurgical Engineers; Ambrose Swasey, of Cleveland, the John Fritz Medal Board of Award and the American Society of Mechanical Engineers; Dr. F. B. Jewett, of New York, the American Institute of Electrical Engineers.

Dr. Ira N. Hollis, president of Worcester Polytechnic Institute and a past president of the American Society of Mechanical Engineers, will accompany the deputation and bear the message from the American engineers.

The John Fritz Medal is a gold medal presented for achievement in applied science as a memorial to the engineer whose name it bears. Previous recipients of the medal have been John Fritz, Lord Kelvin, George Westinghouse, Alexander Graham Bell, Thomas Alva Edison, Charles Talbot Porter, Alfred Noble, Sir William Henry White, Robert Woolston Hunt, John Edson Sweet, James Douglas, Elihu Thomson, and Henry Marion Howe. The medal is awarded to Sir Robert Hadfield this year because of his invention of manganese steel.

The medal was established by the professional associates and friends of John Fritz, of Bethlehem, Pa., on Aug. 21, 1902, his eightieth birthday, to perpetuate the memory of his achievements in industrial progress. There are no restrictions on its bestowal because of either nationality or sex. The trust funds supporting the medal are

held and administered by a board of sixteen directors, consisting of four from each of the four national engineering societies whose representatives make up the mission now on its way to England.

The members of the mission are widely known in the engineering profession. Mr. Main is a past president of the American Society of Mechanical Engineers, past president of the Boston Society of Civil Engineers, and a life member of the corporation of the Massachusetts Institute of Technology. Colonel Dwight is vice-president of the American Institute of Mining and Metallurgical Engineers, a member of the British Institution of Mining and Metallurgy, and a trustee of Columbia University, where he is a leading figure, both in the college administration and among the growing body of its progressive alumni.

Ambrose Swasey is a Cleveland manufacturer, past president and honorary member of the American Society of Mechanical Engineers, member of the Institution of Mechanical Engineers, and president of the Board of Trustees of Dennison University, Granville, Ohio. Mr. Swasey is one of the foremost exponents of industrial research in this country and is internationally known as the original sponsor of Engineering Foundation, to which he has contributed $500,000 for the promotion of research. His latest gift was $200,000.

Dr. Jewett is vice-president of the American Institute of Electrical Engineers, past president of the New York Telephone Society, and chief engineer of the Western Electric Company. He is a vice-chairman of Engineering Foundation for 1921.

The admiration felt by the American engineer for his British fellow worker has been expressed by Calvin W. Rice, secretary of the American Society of Mechanical Engineers, in a communication to Dr. J. H. T. Tudsbery, secretary of the Institution of Civil Engineers, London. In response to cabled greetings, Mr. Rice sent the following message:

"There is a very deep sense of gratitude and obligation on the part of the engineering societies of the United States for the part played by the engineers of Great Britain in the war, and it has been a great deprivation to us that we could not have sooner expressed this in an adequate manner. It is the desire of the engineers of the United States that the presentation be as simple as possible and yet be sincere."

In response to this communication the British Institution of Civil Engineers cabled that it would "welcome and appreciate very highly greetings from the engineers of America at the opening meeting on June 29," and that they "found the occasion very suitable for the presentation of the John Fritz Medal to Sir Robert Hadfield." The delegation which will present the medal sailed from New York by the "Mauretania" on June 15.

Eugène Schneider Awarded the John Fritz Medal for 1922

The John Fritz Medal Board of Award, at a special session last month, awarded its gold medal and diploma to Charles Prosper Eugène Schneider, French engineer, scientist, and man of affairs. The following cable was recently sent to his home in Paris:

"John Fritz Medal Board of Award, representing national societies of civil, mining and metallurgical, mechanical, and electrical engineers, has awarded you the John Fritz Gold Medal for achievement in metallurgy of iron and steel; for development of ordnance, especially the 75-mm. gun, and for notable patriotic contribution to the winning of the war. Letter follows."

Mr. Schneider heads the great Creusot engineering and steel works and shipbuilding plants of France, which, with their subsidiaries, have 100,000 employees. No industrial establishment in the whole world made a greater contribution to the defense of liberty or showed more wonderful resourcefulness under the stress of war from 1914 to 1918.

The German invasion of 1914 reduced almost instantaneously the French output of pig iron about 81 per cent and of steel by 63 per cent. Nevertheless, within two and one-half years, France nearly tripled the number of her blast furnaces and increased the number of her open-hearth furnaces by 60 per cent. During the war she increased her production of rifles 290 fold, of machine guns 70 fold, of 155-cm. shells 225 fold, and of 75 cm. shells beyond reckoning. These achievements were due largely to the genius and energy of Eugène Schneider and his associates.

Mr. Schneider has led not only in the technical and commercial development of the great and varied steel and other engineering industries of France, but he has also given effective attention to the wellbeing of his men and their families. His schools for workmen, foremen, and engineers are among the best in the world. As early as 1877 his company introduced a pension system, antedating similar action by the French government. A very large proportion of his men own their houses and gardens. He has successfully done much to raise the standards, broaden the outlook, and bind the loyalty of his men.

Born on Oct. 29, 1868, at Le Creusot, Eugène Schneider has devoted his life to the development of the great industries which his forefathers founded. Upon the death of his father in 1898, he became the head of the company when only thirty years of age. He was a member of the Chamber of Deputies of the French Parliament from 1898 to 1910. He has received many honors in his own and other countries for his noteworthy achievements. While in the United States in November, 1919, he was presented the gold medal of the Mining and Metallurgical Society of America. His noble and lovable personality has won many friends.

The medal and diploma will be presented to Mr. Schneider in France by the party of American engineers led by Ambrose Swasey, chairman of the Board of Award, which left for France on June 15.

Inaccessible Books and Papers Copied for Students

Many scientists lack the library facilities which their work demands. They are compelled either to journey to distant libraries or to try to borrow books by mail. Often it is difficult for them to locate something that is badly needed.

The Research Information Service of the National Research Council is prepared to assist investigators by locating scientific publications which are not generally or readily accessible. It will also, as is desired, have manuscripts, printed matter, or illustrations copied by photostat or typewriter. The cost of copying varies from 10c. to 25c. per page. No charge is made for this service unless an advance estimate of cost has been submitted and approved by correspondent.

Requests for assistance should be addressed: National Research Council, Information Service, 1701 Massachusetts Avenue, N. W., Washington, D. C.

Ordnance Men Form Manhattan Local

In connection with the organization, under the direction of General Pershing, of the reserve armies of the United States, it was recently proposed to informally associate members of the Army Ordnance Association and the ordnance officers of the Reserve Corps.

The membership of the Army Ordnance Association, of which Benedict Crowell is president, includes about twenty-four hundred technical and business experts who, during the war, served either as officers of the Ordnance Department or as executives of industries engaged in ordnance manufacture.

For the purpose of offering assistance in the organization of the reserve armies and in the solution of local war plans, it was proposed to form in the metropolitan district of Greater New York, a local organization of the Army Ordnance Association which shall include as members all ordnance officers of the Officers' Reserve Corps.

In furtherance of the preceding suggestions a meeting was held at the Engineering Societies' Building, 29 West 39th St., at 8 p.m., Wednesday, June 15. Mr. Guy E. Tripp presided. Short addresses were made by Major General C. C. Williams, Chief of Ordnance; Major General Robert L. Bullard, Commanding General of Second Corps Area; Brigadier General William Weigel, Chief of Staff, Second Corps Area; Colonel Samuel G. Shartle, Assistant Chief of Staff, Second Corps Area; Major M. L. Brett, office of Assistant Secretary of War, and others.

MEN YOU SHOULD KNOW ABOUT

Arthur Keith, of the U. S. Geological Survey, is visiting the marble deposits near Knoxville, Tenn.

William Kelly, of Vulcan, Mich., general manager of the mines of the Penn Iron Mining Co., has sailed for a several months' visit in Europe.

Dr. Henry Mace Payne, consulting mining engineer of 300 Madison Ave., New York City, goes to Mexico next week to examine some silver-lead properties in Jalisco.

J. Morgan Clements, mining engineer, of New York City, who went to Hinan, China, in March on professional business, is expected to return to the United States during June.

Fred P. Williams, formerly with the U. S. Bureau of Mines, arrived June 1, from Colombia, South America, where he had been for the last year engaged in oil explorations for the Colombia Syndicate.

Joseph Irving, specialist in ore leaching processes, is at present testing the amenability of the Dundee-Arizona Copper Co.'s ores to such treatments. His present address is: P. O. box 73, Jerome, Ariz.

O. S. Finnie, acting secretary of the Canadian Northwest Territories, has gone to Peace River and will visit all districts of importance within the oil areas of the North.

H. A. Wheeler, consulting engineer, of St. Louis, Mo., has completed an examination of gas fields in Kansas, and has returned to complete studies previously started in the new Waterloo oil field near St. Louis.

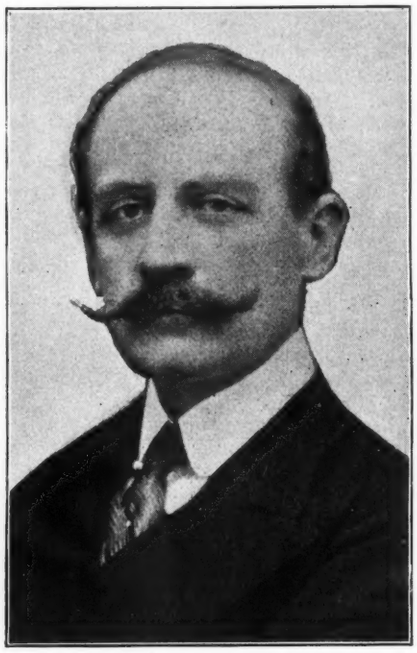
W. L. Whitehead, mining geologist, after more than a year of geologic exploration and mining investigations in Chile, Argentina, Bolivia, and Peru, is now at the Massachusetts Institute of Technology, Cambridge, Mass.

S. C. Ellis, of the Canadian Geological Survey; **Professor Wallace**, of Manitoba, and **W. Webster**, of Saskatchewan, have gone to investigate the Pasquai oil fields west of The Pas, Manitoba.

Victor C. Svimonoff, engineer, formerly of the University of Pittsburgh, returned recently from the Baku oil fields, where he had been in charge of the "Molot" interests for the last eight years. Two months ago he escaped from the Bolsheviki and now has a temporary address at 370 West 120th St., New York City.

George S. Rice, chief mining engineer of the Bureau of Mines, and **Dorsey A. Lyon**, supervisor of experiment stations, will sail from Seattle July 2 for Alaska, where they will gather first-hand information as to the mining situation in that territory, with the idea of devising means whereby the Bureau may be of additional assistance in encouraging mining activities.

Dr. F. G. Cottrell, chairman of the division of chemistry and chemical technology of the National Research Council, sailed on June 11 for Europe to make a survey of the applications being made of helium in European countries. He also will make a special study of oxygen separation and concentration. In this work he is representing the U. S. Bureau of Mines as well the National Research Council.



EUGÈNE SCHNEIDER

Eugène Schneider, Creusot, France, is John Fritz medallist for 1922.

Mining engineers recently in New York City included: **Theodore Chapin**, of Tampico, Mexico; **E. P. Dargin**, recently returned from Ecuador; **H. S. Mulliken**, of the U. S. Bureau of Mines; **L. A. Friedman** of Lovelock, Nev.; **Allan D. M. Rain**, of the Braden Copper Co., Sewell, Chile; **Hallet R. Robbins**, Fierro, N. M.; and **E. H. Nutter**, of Minerals Separation, San Francisco, Cal.

SOCIETY MEETINGS ANNOUNCED

The Regional Meeting of American Society of Mechanical Engineers scheduled to be held at Cleveland, Ohio, on June 13, has been postponed to October.

American Society for Testing Materials holds its twenty-fourth annual meeting at the New Monterey Hotel, Asbury Park, N. J., June 20 to June 24. The "North Asbury Park" station is the nearer one to the hotel.

The Rocky Mountain Coal Mining Institute holds its summer meeting this year in Salt Lake City, Utah, beginning Tuesday, June 28. Headquarters will be at Hotel Utah. Among the speakers will be R. Dawson Hall, editor of *Coal Age*; A. C. Watts, chief engineer of the Utah Fuel Co.; D. C. McKeehan, of the Union Pacific Coal Co.; Benedict Shubart, of Lindroth & Shubart Co., and E. R. Gibson, of the U. S. Fuel Co.

OBITUARY

William H. Williams, general manager of the American-Mexico Mining & Development Co., Velardeña, Durango, Mexico, died at Corpus Christi, Tex., on May 29, after ten days' illness. Mr. Williams went to Mexico a number of years ago, and had carried on mining at Sombrerte, El Tigre, Mapimi, and elsewhere.

Frank A. Keith, mining engineer of Los Angeles, Cal., formerly president and late vice-president of United Eastern Mining Co., of Arizona, died at Los Angeles on June 2 after a prolonged period of ill health. Mr. Keith was born in 1870 at Detroit, Mich., and received his education in the schools of that city, graduating from St. Paul's Academy there.

Immediately after concluding his studies Mr. Keith went west and located in Colorado, where he became surveyor for the Iron Silver Mining Co. at Leadville. This was the beginning of a life that was spent in mining and engineering work in Colorado, Utah, Nevada, and California. After leaving the Leadville company he held successively the following positions: engineer of the Eureka Hill Mining Co., Tintic, Utah; ore purchaser for the Arkansas Valley Smelting Co., Leadville, Col.; assistant manager, Union Smelting Co., Leadville; engineer, De Lamar Nevada Mines Co., in Nevada; general superintendent of the Bamberger De Lamar Mines Co.; engineer, Guggenheim Exploration Co.; general manager, Tonopah Mining Co., of Nevada. These firms are among the most important in the mining industry of America, and the offices Mr. Keith occupied were among the most responsible. He remained in Nevada until 1908, when he moved to San Francisco and opened offices as a general mining engineer. After two years he moved to Los Angeles. One of his first mining ventures thereafter was the organization of the Pacific Mines, which company he managed successfully for a number of years until its sale to others. A short time later he became interested in Oatman, Ariz., and through his activity the United Eastern mine was developed and brought to satisfactory production. He resigned the presidency of this company on account of ill health. He was never able to resume his full business activities, and during the last few months had been confined to his home. Mr. Keith was of a nature that inevitably makes a large circle of friends, and his professional associates will miss his ability and judgment.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

WEEKLY RÉSUMÉ

At Washington a second bill has been introduced providing for the creation of a Federal Department of Mines. Senator Shortridge, of California, is the sponsor of this measure, which differs in various respects from that introduced by Senator Nicholson last week. The bill providing for liberalizing the war minerals relief act came before the Senate for consideration on June 10. Early passage is expected. Ira E. Robinson, of West Virginia, has consented to serve as commissioner to administer the relief act, without associates.

In Nevada the strike conditions at Tonopah and Divide are reported unchanged. The wage cut that was made June 1 on the Comstock has been accepted by the men without demonstration. Lower rates on copper and lead bullion are expected to become effective soon between various western points and the East. In Utah it is reported that the Silver King Coalition Mines Co., of Park City, has reached an agreement with the American Smelting & Refining Co. over the matter of its smelting contract.

Iron-Ore Shipments Fall Off Greatly

The marked decrease in iron-ore shipments from the Lake Superior district so far this season, compared with those for the same period last year, is shown by the following figures: Up to June 1, 1921, a total of 2,770,238 tons has been shipped as compared with 7,206,939 tons for the same period in 1920. During May, this year, 2,594,028 tons was forwarded, as compared with 6,976,085 tons in May, 1920.

Aluminum Co. of America Makes Large Sale of Metal to Australia

Approximately 2,000,000 lb. of aluminum conductor was sold recently to the government of Victoria, Australia, by the Aluminum Company of America. This was in the form of 700 miles of the company's standard 336,400 circular mils steel-reinforced aluminum cable. This is to be used on the Morwell brown-coal power project by which it is proposed to generate sufficient electrical energy to supply the requirements of Melbourne and environs as well as other important industrial centers there.

The Katherine-Union Pass District in Arizona

Small Boom Developed in This Section of Mohave County—Katherine, Katherine Extension, Roadside, Gold Chain, and Other Properties Under Development

BY S. FORD EATON

IN VIEW of the disturbed conditions of the base-metal markets, and the perhaps questionable future position of silver, it is logical that the interest of mining men should turn to the gold-producing sections. The gradual recession of various costs has aided in bringing the metal into prominence. These factors are responsible for the present activity in the old Union Pass district of Mohave County, Ariz. Owing to the Katherine mine being the center of attraction, the district is becoming known as the Katherine-Union Pass district. Roughly, the district covers an area about ten miles square and lies on the western slope of the River Range. It is bounded on the west by the Colorado River. The center of the area is about fifteen miles west of the half-way point on the Kingman-Chloride rail and auto roads. The camp of Oatman lies nearly twenty miles south in the same range.

Pre-Cambrian granites are the predominating rocks. In the southeastern portion, at higher elevations, andesites, porphyries and rhyolites similar to those of the Oatman district are in evidence. In the western half of the Katherine-Union Pass section, erosion has removed all signs of these flows. The veins, for the most part, are intrusive fissures in the granite in which calcite has been replaced by quartz. Pronounced faulting is a general characteristic. At the Katherine the replacement is complete, though in the more easterly properties it exists in varying stages. The values are practically entirely in gold, which is free milling and, though finely divided, horns quite readily. For from three to five miles back from the river the surface is covered by a deep gravel wash. Present shafts show this wash to be from 75 to 100 ft. deep, but undoubtedly portions exceed these figures. At various points the enormous quartz ledges, having resisted erosion, outcrop above the gravel.

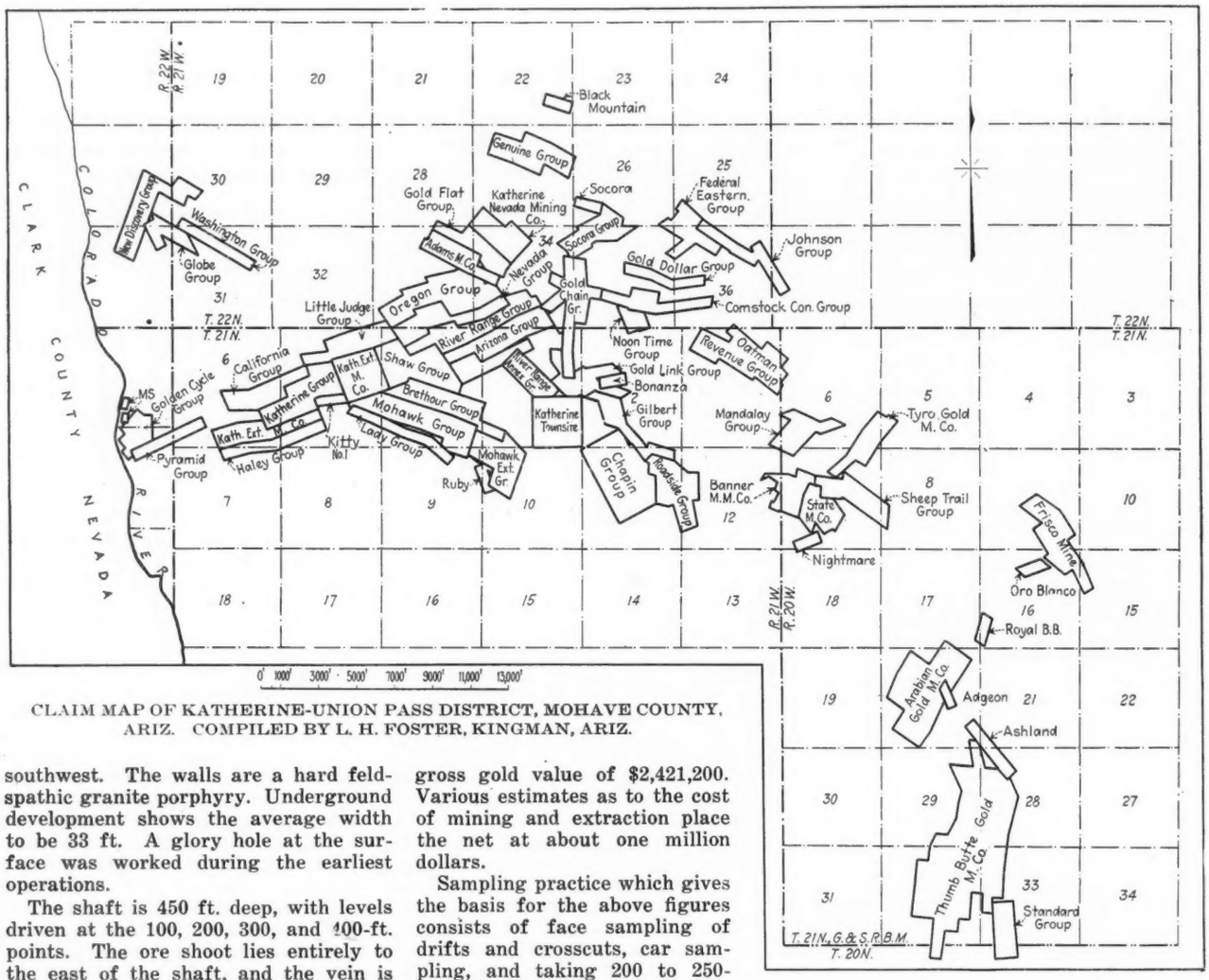
Preliminary symptoms of the present activity began to make their appearance soon after the first of the year (1921). Before long the interest shown by a few outside mining men roused local people, and in March there was a rush for locations. As is usual in this sort of thing, there is today scarcely the equivalent of a claim left in unlocated form. About April 1 the need of accommodations expressed itself in the locating of the Katherine Townsite on the sloping wash about equally distant from the more active properties. By the middle of May there were about two dozen buildings up or in process of construction. These range from simple tent houses to substantially floored structures of corrugated iron. Flivvers with lean-to canvas quarters are still much in evidence. Telephone communication has been established with Kingman and Chloride. There is a daily stage service from Kingman, on the main line of the Santa Fe. A store, a restaurant and a soft-drink establishment seem to be doing a good business, but about June 1 hotel accommodations were still somewhat limited. It is reported that a postoffice has been promised.

THE KATHERINE MINE

The New Comstock Mining Co., financed by Charles Sutro and associates, of San Francisco, has held the property known as the Katherine mine for a number of years. Prior to 1916 development work was carried on in a rather indifferent manner. For a time the property was operated by others under lease and bond. The years 1916 and 1917 saw the work completely shut down. Early in 1918 the company resumed, and the present showing has practically been developed during the last three years.

The Katherine group embraces eight full claims, and these lie along the strike of the Katherine ledge for a distance of 4,500 ft. The property is in the extreme western portion of the district. Buildings and shaft are about two miles from the river at about 500 ft. higher elevation. The present equipment is well housed in large corrugated-iron buildings. Hoist, compressor, and pumping unit total 100 hp. in gasoline engines.

The vein outcrops for a short distance near the shaft. It shows a width of 60 ft. and strikes roughly northeast and



CLAIM MAP OF KATHERINE-UNION PASS DISTRICT, MOHAVE COUNTY, ARIZ. COMPILED BY L. H. FOSTER, KINGMAN, ARIZ.

southwest. The walls are a hard feldspathic granite porphyry. Underground development shows the average width to be 33 ft. A glory hole at the surface was worked during the earliest operations.

The shaft is 450 ft. deep, with levels driven at the 100, 200, 300, and 400-ft. points. The ore shoot lies entirely to the east of the shaft, and the vein is cut up by an interesting series of longitudinal and side step faultings. On all levels crosscuts have been driven through the vein at regular 50-ft. intervals.

Although all estimates are based on the average value of the large low-grade tonnage, a number of high-grade lenses have been found. It is stated that on the 100 level there are several lenses 5 to 6 ft. thick running $100 in gold per ton; on the 200 level, 16 ft. of the vein assays $122, and on the 300 level one 21-ft. section carries $80 and a 6-ft. lens reaches the high mark of $293 per ton.

The ore shoot varies in length on the different levels. On the 100 level it is 287 ft. long, with a width of 15 to 35 ft., the average value being given as $11 per ton. At the 200 level the length is 533 ft., breadth 30 to 65 ft. and the average value $14.45. On the 300 level, the length is 483 ft., the average width 32 ft., and the value $11 per ton. On the 400 level several hundred feet of drifting has been done, but as the crosscuts have not been completed no figures have been given out.

The management estimates the ore blocked out at 190,000 tons. Of this 22,000 tons averages $11, 96,000 tons $14.45, and 72,000 tons $11, making a gross gold value of $2,421,200. Various estimates as to the cost of mining and extraction place the net at about one million dollars.

Sampling practice which gives the basis for the above figures consists of face sampling of drifts and crosscuts, car sampling, and taking 200 to 250-lb. samples across the vein sections in the crosscuts.

Plans have been worked out for a large mill and complete new equipment. It is reported that work will be started on this before 1922. Ray Dimmick is in charge at the mine.

THE KATHERINE EXTENSION

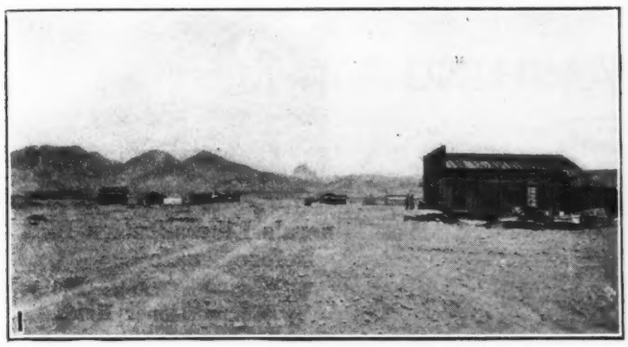
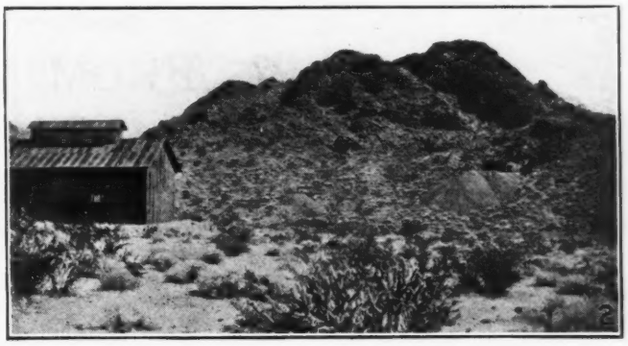
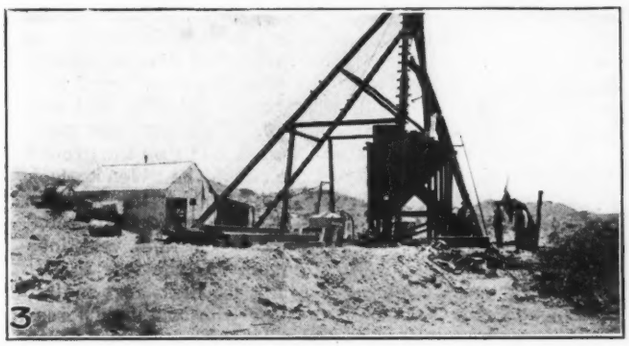
Immediately adjoining the Katherine on the northeast is the Katherine Extension. This group consists of four claims and four half claims located on the strike of the Katherine ledge. C. N. Miller and associates are operating this property. Between April 15 and May 24 these operators installed a hoisting plant in a concrete-floored building, put up a blacksmith shop and change room, erected a 40-ft. headframe, and sank and timbered their shaft 90 ft. through the gravel to bedrock. The first crosscutting for the vein will be done at the 200 level. Sherman & Brethour are doing this work on contract.

THE ROADSIDE PROPERTY

The Arizona-Rand Gold Mine, Inc., with Thad M. Boggs as president and John Sherman Bagg as consulting engineer, has leased the Roadside property, three and one half miles east of the Katherine. The Roadside shaft is 300 ft. deep, with crosscut levels at the 50, 100, and 300-ft. points. The vein at the 50-ft. level is about 50 ft. wide. A 25-ft. section in the center is reported as having an average value of $8 gold per ton. The lower levels at present are under water, the flow of which is 1,600 gal. daily at the 100 level and 6,000 gal. daily at the 300 level. Former operators claim that the vein holds strong in these lower workings, being 50 ft. wide at the 100 level and 86 ft. wide at the 300 level. Unwatering and retimbering of the shaft is going forward rapidly. A contract has been let for 250 ft. of drifting on the 100 level. The equipment consists of a gasoline-driven hoist and compressor.

THE GOLD CHAIN

Probably the most striking showing in the district is that at the Gold Chain property, two and one half miles northeast of the Katherine. The enormous brecciated quartz ledge, 100 ft. wide and striking east and west, outcrops and towers 200 ft. above the wash for a length of many hundred feet. The ledge dips rather flatly to the north and forms a landmark visible for many miles in all directions. A beautiful example of cross-faulting shows in the outcrop, where a 100-ft. section of the vein has been moved north about its own length.

1—TOWNSITE OF KATHERINE, MOHAVE COUNTY, ARIZ., FACETIOUSLY DUBBED KATHERINE CITY. 2—GOLD CHAIN PROPERTY FROM NORTH. 3—ROADSIDE MINE. 4—KATHERINE EXTENSION HEADFRAME AND BUILDINGS

(Views of Katherine and Arabian properties were published in *Engineering and Mining Journal*, April 16, 1921, p. 685.)

Work under F. C. Nourse was started last September. A crosscutting adit was driven into the vein. At the same time a thorough sampling and measuring of the huge outcrop was undertaken. Results from these last give ground for the statement that there are 100,000 tons of $6 gold ore above the adit level. Owing to the extremely favorable physical conditions, the management claims that this tonnage can be mined for about 30c. per ton. One viewing the near toppling mass can readily believe this.

A shaft has been started on the hanging-wall side of the outcrop. A gasoline-driven compressor is ready to operate in a concrete-floored building, and the foundation for a new hoist has been laid.

OTHER PROPERTIES

Development work is proceeding at the Arabian property, as reported in *Engineering and Mining Journal*, April 16, p. 685. It is reported that W. J. Loring has taken over the Sunbeam group. The Adams Mining Co. has opened an office at the townsite preparatory to beginning work. The Sheep Trail, Oatman Revenue, and Thumb Butte are active. In addition to these there are a number of other properties on which the owners are doing location and development work.

The National Lead Co. has purchased and is offering to all its employees common stock in the company at the cost price of $75 a share, payable in sixty monthly payments, deferred payments to draw 6 per cent interest. A similar transaction three years ago sulted in a large oversubscription.

Copper Radiator, Made at Ajo, Being Tested

Manufactured Electrolytically at New Cornelia Plant—Expected to Cost Less, When Perfected, Than Present Kind

Much interest has been aroused in Bisbee, Ariz., by the appearance of the new copper radiator which is being tried out on a Dodge car owned by J. M. Johnson, engineer, and A. G. McGregor, of Warren. The radiator was made electrolytically and is the result of experiments conducted at the plant of the New Cornelia Copper Co., at Ajo, Ariz. Much remains to be done to perfect this radiator so that it will compete with the present types generally in use. It is said that the cost will be considerably less than those now used. It is made entirely of copper, and if it proves successful will mean an important new use for this metal.

Canadian Mining Institute Has Organized Nanaimo Branch

A branch of the Canadian Institute of Mining and Metallurgy has been formed at Nanaimo, B. C., as a result of a recent visit paid to Vancouver Island by George C. Mackenzie, secretary of the institute. Representatives were present from Cumberland, Extension, Ladysmith, Cassidy, and East Wellington, as well as from Nanaimo. Officers were elected as follows: Chairman, George O'Brien, Cumberland; vice-chairman, F. A. Spruston, Ladysmith; secretary-treasurer, W. H. Moore, Nanaimo; local council, John John, Nanaimo; C. M. Campbell, Cassidy; C. Graham and James Strang.

Steel Corporation Files Answer to Trade Commission

Expected That Date for New Trial Will Be Fixed Later

The U. S. Steel Corporation and its eleven subsidiaries filed on June 4 with the Federal Trade Commission an answer to the commission's complaint of last April in which unfair competition in interstate commerce was alleged. The case will now go to trial on its merits before the commission which will determine whether an order should be entered requiring the companies to desist from the practices complained of. The date for the trial will be fixed later.

Smelter at Sumpter, Ore., To Be Operated by New Company

Will Handle Gold and Silver Ores From Nearby District

Organization of a Washington corporation to take over and operate the smelter at Sumpter, Ore., which has been idle for some time, has been practically completed, and head offices of the company are being established in Spokane. The plant will do a general customs smelting business, and it is hoped will afford a profitable outlet for the gold- and silver-bearing ores of parts of Oregon and Idaho, close to Sumpter, but which have been handicapped by long freight hauls to Tacoma, San Francisco, and Salt Lake. No definite date has been set as to when the plant will be put in operation, but officials of the new company are hopeful of having everything ready for starting up by fall or the early part of the winter.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Second Mines Department Bill To Be Introduced

Shortridge Follows Nicholson in Presenting New Measure—Assistant Secretary Provided For

The proposal to establish a department of mines as one of the major subdivisions of the executive branch of the Federal Government has met an enthusiastic reception throughout the country, as is witnessed by the communications reaching Senator Nicholson, of Colorado, who introduced the initial bill at this session providing for the creation of such a department. Many members of the House and Senate have expressed themselves as favoring the project. The representatives of the mining states are practically a unit in their belief that this step is necessary to unify the mining activities of the Federal Government and to prevent the increasing tendency to scatter them among several departments and many bureaus.

Though thoroughly in accord with the general purport of Senator Nicholson's bill, Senator Shortridge, of California, has some different ideas as to the details of carrying out the plan, and before this appears in print he probably will have introduced a bill of his own.

In its present form, Senator Shortridge's bill provides that the name of the department shall be "Mines and Mineral Resources." His measure is somewhat more comprehensive than that of Senator Nicholson, in that it would bring into the new department the Federal Power Commission and the Alaskan Engineering Commission. The Shortridge bill will specify that, in addition to the taking over of the U. S. Geological Survey, the Bureau of Mines, the Federal Power Commission and the Alaskan Engineering Commission, it will include the California Debris Commission of the War Department; the Bureau of Explosives of the Interstate Commerce Commission, and such portion of the work of the General Land Office, of the Bureau of Standards and of the Indian office as relates to the inspection and regulation of mines or mineral industries. The administration of the War Minerals Relief Act also is vested in the new department.

The bill provides for the amending of the existing statute so as to permit the addition of one member to the Cabinet. It also provides for an assistant secretary of mines, who is to be "technically qualified by experience and education," at a salary of $10,000 per year. The measure transfers to the new department the records of the Fuel Administration and those sections of the War Industries Board, the War Trade Board, and the Shipping Board which relate to the mineral industries.

Under the Shortridge bill, the department would be divided into the following subdivisions: Bureau of mineral industry, mine and explosives inspection service, and bureau of power development.

McFadden Gold Bonus Bill Ignored

Ways and Means Committee Too Busy With Tariff Bill To Consider Measure

Owing to the pressure incident to the writing of the new tariff bill the Committee on Ways and Means has not found an opportunity at this session to consider the McFadden gold premium bill. A subcommittee of the Committee on Ways and Means at the last session of Congress reported favorably to the full commission on the bill. No subcommittee has been assigned at this session to consider the measure. This action will be taken as soon as work on the tariff will permit.

I. E. Robinson Accepts Position as War Minerals Commissioner

Enters Upon Duties Promptly—H. G. Pomeroy To Remain Until June 30

Ira E. Robinson, of Grafton, W. Va., has accepted the appointment to be war minerals relief commissioner. He already has entered upon his duties and is making a thorough review of the status of war minerals relief. Horace G. Pomeroy, a member of the commission under the preceding administration, has consented to remain in the service, that he may be of any possible help to Mr. Robinson in making him acquainted with the status of various matters pertaining to the commission's affairs. His resignation, however, will become effective on June 30.

A. H. Fay in Income Tax Unit

Appointed Acting Chief of Natural Resources Subdivision

A. H. Fay has been appointed acting chief of the natural resources subdivision of the income tax unit of the Bureau of Internal Revenue. Mr. Fay is a mining engineer who, for many years, had charge of the statistical division of the Bureau of Mines.

Government's Silver Purchases

Purchases of silver under the Pittman Act during the week ended June 11 totaled 965,000 fine ounces. This brings the total purchases under this act to 58,413,697 fine ounces.

War Minerals Liberalization Bill Before Senate

Expected To Pass—Fall Asks Delay Until New Commissioner Has Studied Situation

The Committee on Mines and Mining of the Senate reported favorably on June 8 a bill providing for the liberalization of the War Minerals Relief Act. The bill went to the calendar and was reached June 10. Objection was made by Senator King, of Utah, on the ground that more time should be given to look into the measure to see if "the bars are let down and the Government subjected to enormous demands and vexatious claims." He expressed the fear that it might afford a precedent for similar claims from those who sustained losses upon the farm or in the factory. After an extended explanation by Senator Ashurst, of Arizona, Senator King withdrew his objection, but further objection was raised by Senator Jones, of Washington.

"I think something ought to be done along these lines," Senator Jones told the Senate, "but in our anxiety to take care of just claims, we ought not to go so far in the language of the proposed legislation as to cover all sorts of claims which might be made against the Government." This action will make for some delay in the consideration of the measure, but Senator Ashurst expects to secure a vote on the bill in the near future. It is certain that it will pass the Senate, as it is almost identical with a bill which passed the upper house at the last session of Congress.

The Committee on Mines and Mining reached the conclusion that a "strict and narrow" construction has been given to the request or demand feature of the existing act. The committee points out that 572 claims were rejected under that construction of the statute. These claims amount to $3,464,023.05. As nearly $5,000,000 of the appropriation for war minerals relief remains unexpended, it is argued that the alteration of the law will not call for the voting of more money. On the other hand, it is argued that the addition of "published request" will call for more money than remains to the credit of war minerals relief, in that it will reopen most of the claims which have been passed upon, because of the change in the date of stimulation. The Secretary of the Interior has asked that this legislation be held in abeyance until the new commissioner has had an opportunity to ascertain if it will not be possible to administer the existing law more liberally than it was administered by the Shafroth commission.

NEWS BY MINING DISTRICTS

London Letter

Rand Mines Must Cut Wages, Says Hugh F. Marriott; Favors Removal of "Color Bar"

BY W. A. DOMAN

London, June 2—As the Central Mining & Investment Corporation group of Rand companies accounts for 47 per cent of the tonnage of ore milled in this great field the remarks of the consulting engineer, Hugh F. Marriott, on working conditions are worthy of attention. The group of mines ranges from the poorest to the richest, and as the properties are widely separated working conditions of the field generally are known to the controlling corporation. Mr. Marriott's report has both its unfavorable and favorable aspects. It is unfavorable in that it shows that the aggregate results of twenty companies, apart from the so-called gold "premium," marked a loss of 2/- per ton milled, and the quantity milled last year was no less than 11,327,312 tons. The average return was 28.04-, and the average working profit 1.71/- per ton. But working profit is not identical with divisible profit, so that when other expenditure is allowed for the result works out at the loss mentioned above. The additional revenue from sales of gold above standard price was £4,913,764, or 8.67/- per ton crushed. This discloses one of the unfavorable aspects, for it is evident that without the premium several of the mines would have to be closed down. Thirteen of the twenty companies paid dividends out of the excess price of gold.

Mr. Marriott has carefully investigated the position to ascertain how costs are made up. From the twenty companies recorded he arrived at the truth, and he finds that, whereas in 1914 the average working costs were 17/2 per ton, they had risen to 25/11 last year, and for the final month the average was 27/4. Native wages have gone up from 3/11 to 4/9 per ton; materials from 5/8 to 9/2 per ton, and other costs from 3/2 to 4/2 per ton, and European wages from 4/9 to 9/2 per ton. The native labor cost increase calls for no comment; "other" costs are partly due to additional benefits having been given to European labor, and the increase of 61 per cent in the cost of materials Mr. Marriott regards as a temporary burden, and one likely to be lightened as old stocks bought at high prices are replaced at a lower figure.

It is to wages paid Europeans that Mr. Marriott devotes particular attention, and it is clear that he regards the increase as quite unjustifiable. European employees constitute one-eighth of the total labor force, and their work, which is mainly of a supervisory character, costs almost double the total expenditure upon the native laborers who carry out the work. It is time not only to call a halt but to bring about a reduction. The white employees in the Rand are the best paid of their class in the world, and palpably if the gold "premium" should vanish no reservoir of money would exist from which to draw funds for wages. Mr. Marriott therefore suggests that pay must be reduced to an economic level, and if this cannot be done there is the implication that some of the mines must cease operations; but he goes a step further and supports the removal of the "color bar" in order that native laborers may be afforded legitimate development to higher classes of work. It is the white miners themselves who are the obstacle to this development.

A matter is mentioned in the report which was not previously known. The mining regulations are "onerous and obsolete," and they "unduly restrict the hours of work of the native laborers to as little as five hours daily." The inference is that the officials who inspect the workings previous to the beginning of the day's work are slow, and that the inspection could be better done in other ways. Obviously, no mining or other industry can be conducted successfully if seven-eighths of the employees put in only five hours effective work daily.

It is fairly evident that Mr. Marriott is of opinion that reforms will be permitted by the Union Government, and it is to longer hours of work, reduced white pay, lower costs of materials and the promotion of the intelligent Kaffir that the favorable aspect of his report may be attributed.

CANADA

British Columbia

Hedley Gold Company To Resume July 1—Premier Strike Over

Ainsworth—It is possible that the Florence mill may resume soon in order to concentrate some milling ore stoped last winter by lessees.

Rossland—The men employed in the various Consolidated mining operations here now number about 250.

Kaslo—The mining depression, which has been most pronounced in this vicinity for several months, shows signs of beginning to lift. There is an indication of some activity up the South Fork of Kaslo Creek, and a possibility of some work being done by lessees of Utica mine.

Poplar—The Bullock Gold Mining Co. is purchasing a compressor and drilling equipment for more adequate development of eleven claims adjoining the Swede and Lucky Jack groups. About 350 ft. of drifting has been done recently. The values are in free milling gold.

Revelstoke—The Waverly Mines Co., of Spokane, is planning to build a wagon road from Albert Canyon, on the Canadian Pacific, to a property recently acquired on Downie Creek. A considerable tonnage of silver-lead ore is said to have been blocked out.

Slocan City—Work has been resumed on the mill at the Ottawa mine, Springer Creek, and it is anticipated that the plant will be ready for operation within a few weeks. The plant is of the selective flotation type and was designed by L. H. Biggar. Its capacity is fifty tons per day. Ore will be brought down from the mine over a 2,000-ft. two-bucket aërial tramway. The tonnage of milling grade in sight is estimated as sufficient for two years' operation.

Fort Steele—The Niagara company, operating the Victor mine, on Mause Creek, continues to keep a small crew, and it is planned to start shipments when the roads improve so as to permit ore hauling. The Gamble Mining Co. has begun the season's placer operations on Wild Horse Creek.

Cranbrook—Dr. S. Schofield, of the Dominion Geological Survey, with two assistants is now camped along St. Joseph's Creek. The party is engaged in connecting up the Cranbrook map area with the Windermere map area, a work which has been undertaken this season at the express desire of the East Kootenay's Prospectors' Association. Another matter receiving attention here by the local mining organization is a plan for the holding of the summer meeting of the Columbia Section of the A. I. M. E. in Cranbrook.

Grand Forks—C. M. Campbell, who has been in charge of dismantling operations at the Granby smelter, at Grand Forks, has gone to Cassidy, Vancouver Island, to become superintendent of the coal mines of Granby company. The entire Grand Forks machine plant equipment of the Granby has been taken over by the Boundary Iron Works. The plant is regarded as one of the most complete in interior British Columbia.

Alice Arm—The Dolly Varden mine, which closed down toward the end of last year, is to be reopened for development, according to a statement by Major G. B. North, the manager. Major North has returned to make a survey and a report on the properties. With market conditions as they are, shipping will not be resumed.

Stewart—Dale L. Pitt, manager of the Premier, has announced that the

strike is over, and that all tramway workers, teamsters, tractor men, and part of the mine crew had returned to their jobs. The tramway construction will be pushed. Two new camps have been opened, and the company is sending out for fifty men, who are to receive $5 a day. The mill is nearly completed, all the tram line right of way has been cleared, and the construction towers have been built.

Several reports are current with respect to the future of the Big Missouri group in the Salmon River district. Pat Daly, who has been in New York for some weeks, is said to have bonded the property and to have received a substantial cash payment in this connection. The report has not been verified. Daly is said to have succeeded, while in New York, in bonding the Fraser group of claims, which are situated on Marmot River, in the Portland Canal district.

Hedley—The Hedley Gold Mining Co. will reopen the Nickel Plate mine on July 1.

Vancouver—The Bullion Mining Co. has once more been the subject of litigation. R. T. Ward, as manager of the syndicate and trustee of the claims, recently asked for an injunction restraining his partners from operating and developing the property along lines that do not meet with his approval. He asked that the thirty men employed be ordered to stop work. It was argued by the other side that Mr. Ward was nominal trustee of the mine only for the purpose of registration of title and that a majority interest was held by those favoring the present development policy, Mr. Ward's interest having been placed, in a previous action, at 3$\frac{1}{10}$ per cent. This view was accepted by the court, and Mr. Ward's application dismissed. At present a 500-ft. tunnel is being driven through rock, disused flumes and ditches are being repaired, and the management expects to make a cleanup this fall.

D. G. Marshall, one of the directors of the Britannia Mining & Smelting Co., has stated that the plans for the new concentrator, to replace the one recently burned, are being prepared and that work will be started within two months.

Victoria—Twenty tons of iron ore are being shipped from the Lake Hill mine of the Puget Sound company's group on the west coast of Texada Island for a test run in the electric furnaces of the firm of Thomas Summerson & Sons, Ltd., Darlington, England.

Queen Charlotte Islands—A party of miners is engaged in another attempt to separate the fine gold from the black sands of the beach near Masset, Graham Island. They have taken in a machine involving a patented process for the purpose.

Hazelton — Preparations are being made by the Kleanza Milling, Mining & Development Co. for an exhaustive examination of the mineralized zones of Kleanza Mountain.

Yukon Territory

Dawson—Navigation has opened and steamers are beginning to traverse the rivers. Miners, prospectors and freight are on their way to the Mayo silver camp. Some gold dredges already have started and others are ready to begin the season's operations. The first gold of the season has left Fairbanks for Dawson.

Ontario

North Crown Mines Shuts Down—Part of Keeley Plant Burned—Trethewey May Build Mill

Porcupine—The North Crown Mines in Porcupine has stopped operating, and all employees have been paid off. It is stated that this will be for only a month, but no definite information on this point is available.

The McIntyre has begun sinking the main shaft from the 1,500 level to the 2,000 level.

The Hollinger gave a contract some time ago for the building of 150 houses in Timmins for Hollinger employees, and has now given a further contract for a bunkhouse to accommodate fifty men. It is reported that it plans to install another 500-ton ball mill.

Dome directors are making a visit of inspection to the property.

The directors of the South Keora Mines will sell 100,000 shares of treasury stock at 15c. a share.

Kirkland Lake—Development work so far on the No. 1 and No. 2 veins on the 600 level of the Lake Shore has indicated a grade of ore as high as that on the upper levels. During March and April the average recovery was $11.35 and $11.94 per ton, respectively, which is much lower than for the previous months.

The Kirkland Gold has recently cut on the 900 level the vein which was found by diamond drilling. The drill core showed 7 ft. of $21 ore, and it is understood that development is satisfactory. The mill is treating 125 tons a day, but the mill heads are lower than for some time past.

Surface work has been started on the Comfort Kirkland, which adjoins the Ontario Kirkland to the west.

After an idleness of several years work has been started on the Goodfish Gold Mines.

The Wright Hargraves mill is now handling 140 tons a day, and it is understood that the management is looking for a production of approximately half a million dollars this year.

Cobalt—During May the O'Brien mine produced 312,000 oz. from mill heads averaging 51 oz. to the ton. This is approximately one-quarter of the 1920 production and one-half of the 1919 production.

The transformer house and transformers of the Keeley mine have been destroyed by fire, and this has entirely cripped mine operations.

The Trethewey Mines in Gowganda is sinking from the 165 to the 265 level. The company is considering the erection of a mill.

MEXICO

Power Shortage at El Oro Hampers Operations

El Oro—Alarm is being felt in the mining regions of this state over the diminishing electric power available. Some companies are manifesting their intention of suspending operations unless the deficiency is remedied. An appeal has been made to the federal government. The light and power companies are unable to secure sufficient oil and coal to keep their power plants at full capacity.

Aguascalientes

A. S. & R. May Blow in Lead Furnace Soon

Aguascalientes — Governor R. Arellano Velle has been in Mexico City conferring with federal officials in an effort to relieve the silver mining industry in this state.

The American Smelting & Refining Co. is said to be operating two copper furnaces at its Aguas plant and expects to blow in one lead furnace soon. This smelter is receiving considerable copper ore from the Sombrerete district, in Zacatecas. As soon as the lead furnace is blown in the ores from the San Juan de Guadalupe district will be shipped to Aguascalientes instead of to Chihuahua.

Zacatecas

Installing Mine Sampling Unit at Fresnillo

Zacatecas—Charles E. Snider has taken up the Guarda group of gold-silver mines at La Noria, Sombrerete, and is preparing to develop them. This property is next to the lead-silver mines known as the Oscar, San Antonio, and Soledad. Shipment will be made to Aguascalientes.

John O. Emerson has applied for titles to fifty-four mining claims at San Miguel del Mezquital. These claims are to form the Santa Catarina group. The survey is to include the old Santa Catarina shaft, which has been abandoned for years. This shaft produced a large amount of high-grade gold, silver, and lead ore, and was worked some distance below the water level. It is claimed that there are yet some good orebodies to be found above the water with proper development work.

George H. Davis is developing the Purisima mine at La Noria.

Walter Palmer is operating the Noria mine, in this district, and is shipping to Chihuahua and Aguascalientes.

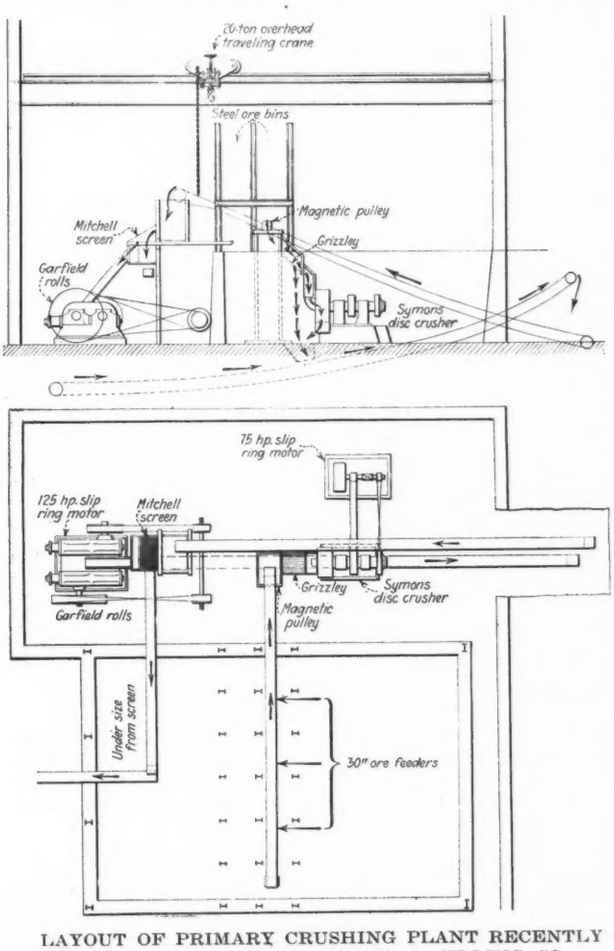
Gerald E. Norton, representing John Emerson, has filed on forty claims to be titled under the name of El Compromiso. The group is a short distance north of San Miguel del Mezquital. The denouncement includes some old workings, which will be cleaned out and redeveloped.

Fresnillo—G. W. Voelzel has accepted an eight-month engagement with the Mexican Corporation to install a complete mine sampling system at the company's Fresnillo unit.

Chihuahua

Alvarado Company Erects New Primary Crushing Plant

Parral—The Alvarado Mining & Milling Co. has constructed a primary crushing plant having a capacity of seventy-five tons of ore per hour. The ore is delivered to this plant in 4-in. size and is reduced to ½ in. The equipment consists of one 48-in. Symons disk crusher and one set of 54 x 20-in. Garfield rolls working in closed circuit with a 72-in. Mitchell vibrating screen. The layout of this plant, which is an addition to the old mill, is shown in the accompanying illustration. A 5 x 16-ft. Ball-Peb mill, using 2-in. steel balls, has been added to the fine-grinding equipment. This is in closed circuit with a 10-ft. Dorr bowl classifier.



LAYOUT OF PRIMARY CRUSHING PLANT RECENTLY BUILT BY ALVARADO MINING & MILLING CO., PARRAL DISTRICT, CHIHUAHUA, MEXICO

The company has two three-compartment inclined shafts at the Perseña group of mines on the Red vein (Veta Colorado). Each shaft has been equipped with two 80-cu.ft. ore skips and with a Denver Engineering Works Co. double-drum electric hoist with a 150-hp. motor. Solenoid brakes are attached to the motor shafts and there is full magnetic control. Clutches and brakes are operated with oil pressure pumps. The brakes are of the post type. The hoist drums are grooved for 1-in. hoisting rope. The rope pull is 12,500 lb. and the hoisting speed 400 ft. per minute.

A Sullivan twin-angle compound compressor of a capacity of 2,000 cu.ft. of air per minute at 5,000-ft. altitude has been installed. This is direct connected to one 350-kva. synchronous motor.

ARIZONA

Shattuck Opens New Ore on 600 Level —Copper Queen's Boras Shaft To Be Sunk Under Contract

Bisbee—At the Shattuck a new ore-body is being opened up on the 600 level. Development has not proceeded for enough to indicate its size. So far on the 600 level it is 100 ft. long and averages 6 per cent copper. Thus far it has not been opened on the 700 level. Raises from the 700 cut the ore a short distance above the level. Present indications point to the fact that this is an important discovery.

The Boras Leasing Co., which has a lease on the Boras claim, has taken a contract to enlarge and sink the Boras shaft for the Copper Queen. The shaft is down to the 700 level. It will be enlarged to two and one-half compartments and sunk an additional 400 ft. The leasing company has discontinued its development work and has begun to enlarge the shaft from the 400 level to the surface.

Jerome — Dundee-Arizona has started a one-ton experimental mill on its carbonate ores, of which a large tonnage, sampling from 3 to 7 per cent copper, awaits development of a satisfactory reduction process.

The Yavapai County Court has made permanent its injunction against the Mitchell-Frazier interests in the Jerome-Superior and has decided that the meeting was legal at which control was taken by the faction headed by George A. Kobold. The mine has been unwatered and will employ electric pumping. Further operations will depend upon the report of sampling and examination now being prepared.

Pearce — High-grade ore has been found in an old abandoned drift on the Rainbow claim of the Commonwealth Extension, which is being operated by Guy Emmons and associates under lease. The vein is 2 ft. wide.

CALIFORNIA

Broken Hills Before Public Again—To Cut Wages July 1 at Grass Valley—Southern Pacific To Publish New Rates East on Bullion

San Francisco—An advertisement appears in the *San Francisco Chronicle*, May 28, 1921, in which the president and two directors of the Broken Hills Silver Corporation advise the stockholders of the Broken Hills Silver Corporation not to be stampeded by "false reports" and to hold their stock. On good authority it is stated that a telegram by the Fidelity Finance & Funding Co. is being circulated in which it is alleged that the company owes about $9,000, and suits have been started by certain creditors. It is further alleged that the south drift on the 350 level has been abandoned because no ore was found; that no ore was found in the north drift after drifting more than 150 ft.; that developments on the 250 level were also disappointing; and that three of the directors have assumed control of the company.

The Southern Pacific Co. is arranging to publish a rate of $16.50 per ton on copper bullion, copper matte, blister copper, also lead bullion and speiss, carloads, minimum weight 60,000 lb., from Clifton, Globe, Hayden, Miami, Cananea, Ajo, and other points in Arizona and New Mexico to New York and Laurel Hill, N. Y., Chrome, Perth Amboy, Cartaret and Newark, N. J., via Southern Pacific to Galveston, thence via Southern Pacific Atlantic Steamship Lines. The present rate is $20 per ton.

Jackson—The Kennedy mine has been unwatered to a depth below the 3,800 level, and the shaft at this depth is below the intersection of the vein and in hard country rock. It is believed that no further shaft repairs will be necessary and that unwatering can proceed steadily until the lower levels are recovered.

The Argonaut is reported to have a full complement of men and to be operating thirty stamps.

Sutter Creek — According to the weekly report of A. S. Howe, superintendent of the Central Eureka, the vein in the south drift of the 3,350 level has widened to 2 ft.

Prospecting work on the Old Eureka has been definitely suspended. After deepening the shaft to the 3,500 level and crosscutting and diamond drilling, the results were stated to be negative and the work of about five years without satisfactory results.

Grass Valley—Wage reductions to take effect July 1 at the Empire, North Star, and Idaho-Maryland mines have been announced following a conference of W. B. Bourne, of San Francisco: George B. Agnew, of New York, and Bulkeley Wells, of Denver.

Assurances have been given locally that the deferred payroll of the Allison Ranch mine will be met and that operations will be suspended and the mine kept free from water pending negotiations for a sale of the property.

Keeler—The Cerro Gordo company has begun construction of a new mill to be completed early in July.

The Inyo Talc Co. anticipates a good season and will increase shipment despite high freight rates.

Operations have been resumed by the National Soda Products Co. and a number of good contracts insure continuation of operations.

NEVADA

Comstock Miners Accept Cut—Knox Divide, Unable To Ship, Engaged in Development Work

Virginia City—In accordance with an agreement between the labor organizations of Virginia City and Gold Hill and the operators, wages were reduced at both camps on June 1, the reduction being 50c. per shift for miners and 75c. for muckers, making their wages $5 and $4.50 per day, respectively, and making the pay of top labor $4.25 and that of mechanics $6. An unsuccessful attempt was made to cause a walkout and tie up operations. A. Bordsen, representing the executive council of the International Union of Mine, Mill and Smelter Workers, with which the Gold Hill miners union is affiliated, arrived in Gold Hill on June 1, presumably to support the agreement between miners and operators. Underground crews on that day were about 75 per cent complete, and top crews full. Conditions are expected soon to revert to normal on the Comstock.

Weepah—The Electric Gold Mines Co. is developing a large free-milling gold property at Weepah, about thirty miles southwest of Tonopah. The property is in the prospect stage, the deepest shaft being down 75 ft. The quartz vein is wide and has given good assays. A camp has been established, headframe built, gasoline hoisting plant and a small air compressor installed. Crosscutting is now being done on the 75 level.

Klondyke—The Knox Divide, being unable to ship any ore on account of the closing down of all custom mills in the Tonopah district, is doing necessary development work with satisfactory results. A winze on the vein has been sunk 30 ft. below the 60 level, above which practically all ore produced to date has been mined. The winze is in milling grade ore and the vein is said to be 12 ft. wide. Conditions are excellent in the east drift on the 60 level. An east drift has been started on the 130 level on the contact to cut the projection of the orebodies as developed on the 60 level at this depth.

Tonopah—The labor situation remains unchanged in the Tonopah and Divide districts. The Tonopah Extension and Belmont companies are still trying to build up crews by importing labor. Orderly conditions prevail, with an occasional verbal demonstration when any of the imported men appear on the streets. In a letter to stockholders, dated June 1, Clyde H. Heller, president of the Belmont company, explains that owing to the refusal of the employees to accept a 12½ per cent reduction in wages and the consequent strike the directors have deemed it unwise to declare a dividend at this time.

Hornsilver—The option held by the Tonopah Mining Co. on the Orleans mine has been terminated on account of the refusal by J. W. Dunfee, the lessee, to consider any change in the original agreement between himself and the Tonopah Mining Co. Dunfee claims to have a drift face, 7½ x 10 ft., entirely in $40 ore.

Candelaria—According to a statement by Charles D. Kaeding, consulting engineer and manager for the Candelaria Silver Mines Co., construction will be begun at once on the first 150-ton unit of a cyanide plant. Crushing equipment capable of handling 400 tons per day will be installed. This first unit will probably be completed by September, by which time the power line extension from Hawthorne is expected to be completed also.

COLORADO

Powder Price Cut at Cripple Creek—Golden Cycle Only Dividend Payer

Cripple Creek—The price of powder has been reduced $1.75 per 100 lb., and caps have come down $1.25 per 1,000. Powder is now selling in the district at $18.50 per 100 lb., compared to the high price of $26.75 about two years ago.

Independence — The Golden Cycle Mining & Reduction Co. paid its quarterly dividend of 2 per cent on June 10. The amount was $30,000. Outside of certain leasing pools operating in the district the Golden Cycle is the only dividend payer in the camp at present.

UTAH

Silver King Coalition and A. S. & R. Co. Agree on Smelting Contracts—Daly West Still Opposed

Park City—Shipments for the week ended June 4 amount to 1,097 tons, as compared with 993 the preceding week. Shippers were: Judge allied companies, 611 tons; Ontario, 268; Silver King Coalition, 218.

It is announced that the controversy between the Silver King Coalition and the American Smelting & Refining Co. over smelting charges has been settled satisfactorily to both parties. As is evident from the above list, the Coalition is resuming shipments. As regards the Daly West in a similar controversy with the smelting company, which, as in the case of the Silver King, was seeking to increase smelting charges above those allowed in the smelting contracts, officials of the mining company announce that the differences have not been settled.

Eureka—Shipments for the week ended June 4 amounted to 119 cars as compared with 123 cars the week preceding. Shippers were: Tintic Standard, 44 cars; Chief Consolidated, 38; Eagle & Blue Bell, 7; Iron Blossom, 6; Iron King, 6; Dragon, 6; Victoria, 4; Gemini, 2; Alaska, 2; Colorado and Swansea, 2.

Salt Lake City—The camp of Alta, in Little Cottonwood Canyon, Utah, is being made more accessible this season. Both the narrow-gage railroad from Wasatch to Alta and the wagon road to the camp are being improved, the latter so as to be passable to automobiles for the first time. It is hoped to have the narrow-gage opened by the middle of June, so that ore may be coming down soon. The South Hecla, Albion Consolidated, South Hecla Extension, and the Alta-Michigan, all under the same management, are preparing for an active summer. New ore is said to have been opened during the winter at the Sells and the Columbus-Rexall. The Michigan-Utah has finished repairing the aërial tramway.

MICHIGAN

Gogebic Range

Ironwood and Wakefield Companies Object to City Bonds Recently Voted

Wakefield—Some of the mining companies operating mines in the city of Wakefield are objecting to the issue of bonds which were voted at a recent election. The people of Ironwood also have voted to issue more bonds, and have practically granted the City Council the power to issue bonds for any purpose and in any amount they wish without referring the question to the people. The opinion is expressed that that city would soon be in the class of Hibbing, Buhl, and Chisholm, Minn., as regards taxation and amount of money spent per capita of population.

Gile, Wis.—The Cary mine, which has been working with a reduced force, has closed down, laying off about seventy-five or eighty men.

Marquette Range

Work Resumed at Mary Charlotte

Negaunee—Operations have been resumed at the Mary Charlotte mine. Two shifts are being worked full time, and it is the only mine in Negaunee being operated full time. Shipments are to be started soon.

Menominee Range

Work Stopped at Odgers Mine

Crystal Falls—The McKinney Steel Co. has stopped all work at the Odgers mine. It has also ceased mining at the Colby and Ironton mines at Bessemer. Very few of the Menominee Range properties are in operation, and most of those being worked are on a part-time basis.

MINNESOTA

Mesabi Range

Gilbert—The Pickands Mather Co. has stopped operations at all of its properties on the Mesabi Range. Those affected are the Corsica mine, at Gilbert; the Belgrade, at Biwabik, and the Mohawk mine, at Aurora.

Aurora—The St. James mine, operated by the McKinney Steel Co., has been closed down indefinitely.

THE MARKET REPORT

Daily Prices of Metals

June	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
9	12.75	28 375	29 25	4.50@4.65	4 40@4.50	4.45
10	12.75	27.875	28 875	4.50	4.25@4.50	4.45
11	12 75	27.875	28.875	4.45@4.50	4 25	4.40@4.45
13	12.60@12.75	27.875	28 875	4.40@4.50	4.20@4.25	4.40@4.45
14	12.60@12.75	28 25	29.25	4.40@4 50	4.20	4.40@4.45
15	12.60@12.75	28.75	30.00	4.35@4.40	4.20	4.40@4.45

*These prices correspond to the following quotations for copper, "delivered": 13c. for June 9, 10 and 11; 12.85@13c. for June 13, 14 and 15.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

June	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
9	73½	73⅝	77	168¾	170¾	23¼	22⅞	26¾	27¾
10	73	73¼	77	165¾	167¼	23⅛	22⅝	27	27⅞
11	...	...	...	....	....	...	...	...	...
13	73⅛	73⅜	77	167	169¼	22½	22	27¼	28
14	73⅜	73⅜	77	167½	169½	22⅜	21⅞	26¾	27⅛
15	73	73⅛	77	168¾	171½	22¼	22	26¾	27⅝

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

June	Sterling Exchange	Silver			June	Sterling Exchange	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York, Foreign Origin	London
9	370	99¼	57⅜	35	13	373½	99¼	59⅛	35¾
10	372½	99¼	58½	35½	14	375¼	99¼	59	35⅝
11	374¼	99¼	59½	35¾	15	376½	99¼	58⅜	35

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, June 15, 1921

Those who have followed the metal market for many years cannot remember any time when conditions were so dull as at present. Often a poor domestic demand has been offset by better markets abroad, but now the stagnation seems to be international. Little hope can be had from a survey of the stock market, which is supposed to reflect business conditions from six to eight months in the future, for current prices of securities are practically at the extreme lows reached last December. Conditions in England are demoralized by the continuance of the coal strike, and they are little better in France. Germany shows some signs of an industrial revival, but is laboring under obvious disadvantages. Metal producers are trying to be as optimistic as possible in view of the fact that present prices are below the cost of production and therefore cannot continue indefinitely. Labor costs are slowly becoming lower, but still have a considerable distance to go to reach the comparative levels of metal prices. It seems likely that before wages reach pre-war levels prices will have shown improvement.

Copper

The larger producers continue to quote 13.50c. delivered, and we heard of one carload sold at this price. Smaller interests have tried to sell a little copper at 13c. delivered, and possibly two million pounds has been marketed at this price; in other cases, however, consumers have informed would-be sellers that metal was obtainable for 12.7[illegible] and have turned down the higher offers. It is likely that June copper could be obtained today at 12.875c., with a premium of about one-eighth cent for each month in the future. Export demand continues almost non-existent.

Lead

Late Friday afternoon, June 10, the American Smelting & Refining Co. reduced its official price for lead from 4.75c. to 4.50c., New York and St. Louis. This was in accord with conditions obtaining in the open market.

Demand from consumers has been almost non-existent during the last week, even inquiries being scarce. The price is being depressed by continued weakness in London, accompanied by further declines in sterling exchange which would have made importations profitable had not domestic prices been reduced. Some producers are unwilling to sell lead for less than 4.50c. in the middle West, and if they persist in this attitude the price is likely to react to that figure, particularly for such brands as they control.

Today one interest is reported to be offering lead as low as 4.25c., New York, in an effort to market current production.

Zinc

The zinc market has been as quiet as that for the other metals, the exceedingly low prices current not tempting purchasers. Conditions were reported particularly weak on Monday, with a slight improvement in evidence today, though one producer reports that he is willing to sell at 4.35c.

Tin

Tin is somewhat stronger, in sympathy with London, and not because of any increase in demand here. Sellers of 99 per cent grade are not as anxious to find a market as formerly, for there may be some difficulty about getting future supplies. Tin for forward delivery is quoted at the same price as spot.

Arrivals of tin, in long tons: June 8, Buenos Aires, 32; 13th, London, 50; Rotterdam, 50; Straits, 15.

Gold

Gold in London: June 9, 110s. 4d.; 10th, 111s.; 13th, 110s. 5d.; 14th, 110s.; 15th, 109s. 2d.

Foreign Exchange

The weakness in sterling has continued, and at one time a low of $3.695 was reached. The cause is not clearly understood. On Tuesday, June 14,

francs were 7.98c.; lire, 5.13c.; and marks, 1.4525c. New York funds in Montreal, 12½ per cent premium.

Silver

The London price for silver advanced sharply the last week owing to speculative buying, as well as a brisk demand for India bazaars. At the high level of 35⅜d., re-sales of silver by India satisfied buyers, causing a reaction in price to 35d. on June 15.

There was a brisk demand from China buyers in both the New York and London markets on June 13, on the basis of 35⅜d., due to improvement in China exchanges, but, buyers being satisfied, China exchanges have suffered a relapse and close weak with buyers holding off. The Continent has been selling silver more freely in London, and there have also been some further imports of German silver in the New York market in the last week.

The important factors affecting the price of silver are the course of sterling exchange, which is very uncertain; the decreased production of silver, which is quite marked; and the economic conditions in China and India, which still continue poor. The monsoon season is now due in India, and a great deal will depend on whether rains are plentiful enough to assure crops for the coming season, which will have a decided result in trade exports of India, and if the monsoon is favorable, the India demand should improve. The outlook for silver is uncertain and dependent on all the above noted factors, and the course of the market is likely to be sluggish until some new factor such as Government sales of demonetized metal or a revival of trade gives the price a decided impetus in one direction or the other.

Mexican Dollars—June 9, 43⅞c.; 10th, 44⅜c.; 11th, 45¼c.; 13th, 45¼c.; 14th, 45¼c.; 15th, 44⅜c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 22@23c. per lb.; 22½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 5½@5¼c.; market dull. W.C.C. brand, 5⅞@6¼c. per lb. Cookson's "C" grade, spot, 9⅜c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb., 500-lb. lots.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $4 per lb.; black oxide, $3@$3.10 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, $200@$180 per oz. Because of dullness in automobile trade very little iridium is going into contact points. Manufacturing jewelers also are not consuming much iridium.

[1]Molybdenum Metal in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70@$80 per troy oz.

Palladium—$65@$70 per oz.

Platinum—$75 per oz.

Quicksilver—Nominally, $46@$48 per 75-lb. flask. San Francisco wires $47.50.

[1]Rhodium—$150 per troy oz.

[1]Selenium—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]Thallium Metal—Ingot, 99 per cent pure, $20 per lb.

[1]Tungsten Metal—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $30; ground, $35; f.o.b. Atlantic ports. Quotations are nominal. Market very dull.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $7.45; Mesabi bessemer, 55 per cent iron, $7.20; Old Range non-bessemer, 51½ per cent iron, $6.70; Mesabi non-bessemer, 51½ per cent iron, $6.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5.80; old bed concentrates, 63 per cent, $6.70; Harmony, cobbed, 63 per cent, $6.70; new bed low phosphorus, 65 per cent, $9.50.

Manganese Ore — 25c. per unit, seaport; chemical ore (MnO_2) $55@$60 per gross ton, lump; $70@$75 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]Titanium Ores—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]Zircon—Washed, iron free, 3c. per lb.

[1]Zirkite—According to conditions, $70 @$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

[1]Furnished by Foote Mineral Co., Philadelphia, Pa.

Zinc and Lead Ore Markets

Joplin, Mo., June 11—Zinc blende, per ton, high, $28.40; basis 60 per cent zinc, premium $21.50; Prime Western, $21; fines and slimes, $20@$17.50; average settling price, all grades of zinc, $27.07.

Lead, high, $58.10; basis 80 per cent lead, $50@$45; average settling price, all grades of lead, $48.92 per ton.

Shipments for the week: Blende, 3,834; lead, 1,224 tons. Value, all ores the week, $163,680.

Owing to a bulk of the shipments being of highest-grade blende, some of which was bought several weeks ago, settling averages show a marked advance over those of last week. Demand was strong this week on $20 basis, with light transactions at that figure, most of the tonnage selling on $21 to $21.50 basis. Report, unverified, of $22 basis was made. Lead ore weakened to $45 basis after midweek, a considerable tonnage selling earlier on $50 basis.

Platteville, Wis., June 11—No sales of blende or lead ore. No shipments of finished blende. Shipments for the year: Blende, 11,461; lead, 910 tons. Shipped during the week to separating plants, 285 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1,700@ $3,000; No. 2, $1,200@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@ $75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7 per long ton, f.o.b. Cartersville, Ga.

Bauxite—High-grade French bauxite, $8@$12 per ton, Atlantic ports. American quotations the same. Consumers generally well supplied. Prices vary according to grade. Crude, unground, $16.50 per ton; ground, $22; calcined, ground, $35; unground, $45, f.o.b. plant.

Chalk—English, extra light, 5@5½c. Domestic light, 4½@5c.; heavy, 4@4½c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $7@ $9; washed, $9@$10; powdered, $13@ $20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@ $20, f.o.b. Virginia points. Imported lump, $12@$20. f.o.b. American ports; powdered, $35@$45, f.o.b. New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b. New England points.

Feldspar—Crude, $7@$14 per gross ton, f.o.b. Maryland and North Caro-

lina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$22.50 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $12.50, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF_2, $32, New Mexico.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 7@7½c. per lb.; chip, 5½@6c.; dust, 3¼@4c. No. 1 flake, 6½c.; amorphous crude, ¾@2¼c. Market quiet. Consumers ordering only small lots to cover immediate requirements.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$2 per net ton; 1½ in., $1.50@$2. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $56 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned — $33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 3, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); ground roofing mica, $25@$70, all f.o.b. New York.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12.50; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $6.75; 68 per cent, $6.25; 68@66 per cent, $6.

Pumice Stone—Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

[1]Foote Mineral Co., Philadelphia, Pa.

Pyrites—Spanish fines, per unit, 14c., c.i.f. Atlantic seaport; furnace size, 14c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 12 @ 14c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $18@$40, talcum powder grade. Southern talc, powdered, carload lots, $10@$14 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic — White arsenic, 6½c. per lb. in carload lots.

Sodium Nitrate—$2.85@$3 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $18@$20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; $33@$35 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.50@$1.75 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 14c. per lb. of chromium contained; 4 to 6 per cent carbon, 15c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $75@$80, f.o.b. furnace; resale, $90, delivered; English, $75@$80, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $30@$32, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $42@$45; 50 per cent, $70@$75; 75 per cent, $140@$145.

Ferrotungsten—Domestic, 70 to 80 per cent W, 50@55c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$5@$6 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 21.50c. per lb.; wire, 15c.

Lead Sheets—Full lead sheets, 8.25c.; cut lead sheets, 8½c. in quantity, mill lots.

Nickel Silver — 31½c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets 17½c.; sheathing, 16½c.; rods, ⅝ to 3 in., 14½c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina $35@$50 per ton, f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $60@$65 per net ton, shipping point; arches, keys, wedges, $66; splits, soaps, $84.

Fire Brick—First quality, 9-in. shapes $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $70@$75 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98, f.o.b. works.

Silica Brick—9-in., per 1,000: $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, June 14, 1921

The stagnation in demand for pig-iron and steel products has grown even more pronounced. Orders are few and are usually for single carloads. Production of steel is now at less than 25 per cent of capacity, yet the inflow of orders at the moment is not sufficient to promise maintenance even of this low rate. In May, steel production was at about 38 per cent by the Steel Corporation and 32 per cent by the independents, the latter having had a spell of good sales in April when they were withdrawing the lowest of their cut prices. Their average operation now is estimated at under 20 per cent. The Steel Corporation is operating at about 30 per cent.

There is no price issue now between the steel producers and their customers. Many steel consumers have large stocks of their finished wares, such as agricultural implements, and reductions in steel prices just now would not be to their advantage. Later the steel mills will doubtless endeavor to pick out a situation in which sharp price reductions would stimulate buying, so that by a larger operation costs would come down. Present prices represent losses to most producers, on account of low operating rates.

Pig Iron—Foundry iron has declined 50c. to $22.50, Valley, bessemer remaining at $23 and basic at $21.50.

Coke

Connellsville—Furnace, $3.25@$3.75; foundry, $4.50@$5.

World's Production of Copper, Lead, and Zinc, 1911-1920

Prepared by the American Bureau of Metal Statistics

World's Production of Copper

Statistics Based on Blister Copper Referred to Countries Wherein Ore Originated

(In Metric Tons—2,204.6 Lb.)

Country	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
North America:										
United States	491,600	563,300	557,400	525,529	646,212	881,237	872,065	879,026	548,677	576,450
Mexico	61,900	73,700	52,800	36,337	30,969	55,128	47,503	75,529	60,491	50,480
Canada	25,300	35,300	34,900	34,027	47,202	47,985	50,626	52,693	36,106	35,500
Cuba	3,800	4,400	3,400	6,251	8,836	7,816	10,313	12,337	9,974	6,485
Total North America	582,600	676,700	648,500	602,144	733,219	992,166	980,507	1,019,585	655,248	668,915
South America:										
Bolivia	2,600	3,700	3,700	3,874	5,868	5,150	6,400	6,000	7,000	9,900
Chile	36,420	41,647	42,263	44,665	52,341	71,288	102,527	96,565	63,930	94,531
Peru	27,735	26,969	27,776	27,090	34,727	43,078	45,176	44,414	39,470	31,276
Total South America	66,755	72,316	73,739	75,629	92,936	119,516	154,103	146,979	110,400	135,707
Europe:										
Austria-Hungary	2,600	4,000	4,100	3,500	3,500	3,500	3,500	2,500	1,000	1,000
Germany	22,400	25,600	25,300	25,000	25,539	24,796	28,632	15,101	15,775	17,255
Norway	1,565	2,130	2,741	2,859	2,826	1,614	1,810	2,856	1,800	1,400
Russia	25,700	33,500	33,900	31,938	25,881	20,887	16,000	.....	.....	.....
Spain and Portugal	51,800	59,900	54,700	37,099	46,200	42,000	42,000	41,000	40,000	25,000
Sweden	3,221	3,957	4,215	4,692	4,561	3,181	4,423	2,956	3,558	3,500
Serbia	7,000	7,400	6,400	4,443	3,200	5,000	11,200	6,000	1,209	2,436
Total Europe	114,286	136,487	131,356	109,531	111,707	100,978	107,565	70,413	63,342	50,591
Asia:										
Japan	53,402	62,423	66,500	70,463	75,416	100,635	108,038	90,323	81,865	65,554
Total Asia	53,402	62,423	66,500	70,463	75,416	100,635	108,038	90,323	81,865	65,554
Australasia	45,979	46,343	45,647	38,667	37,709	39,855	36,564	44,722	16,441	26,486
Africa	17,300	16,600	22,900	27,033	31,300	39,815	42,656	31,064	31,350	32,230
Other Countries	6,300	5,300	3,800	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Grand totals	886,622	1,016,169	992,442	928,467	1,087,287	1,397,965	1,434,433	1,408,086	963,646	984,483

World's Production of Lead

(In Metric Tons—2,204.6 Lb.)

Country	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
North America:										
United States	368,140	376,413	395,340	488,737	486,185	537,277	527,729	462,878	412,701	432,355
Canada	10,786	16,219	17,080	16,483	21,009	18,823	14,776	23,314	19,876	15,413
Mexico	124,600	108,000	62,000	23,598	31,384	19,966	46,612	88,503	78,645	84,200
Total North America	503,526	500,632	474,420	528,818	538,578	576,066	589,117	574,695	511,222	531,968
South America:										
Argentina	.....	.....	.....	1,088	1,546	1,611	2,743	3,436	3,965	3,500
Other South America	2,535	2,295	2,476	1,766	2,689	2,261	1,405	1,345	2,600	1,500
Total South America	2,535	2,295	2,476	2,854	4,235	3,872	4,148	4,781	6,565	5,000
Europe:										
Austria-Hungary	19,600	21,400	24,100	32,000	34,500	36,500	34,400	33,000	1,764	1,800
Belgium	44,300	51,200	53,590	70,980	16,770	15,560	22,745	20,630	4,225	8,000
France	23,600	31,100	28,817	29,601	14,539	24,276	21,235	12,778	10,928	12,000
Germany	164,300	176,700	188,000	180,250	121,700	106,807	86,228	70,000	51,500	54,400
Greece	14,300	14,500	18,309	20,684	11,595	9,426	1,422	4,093	3,841	4,000
Italy	16,700	21,500	21,674	20,464	21,812	24,362	16,237	18,332	16,530	15,915
Russia	1,000	1,000	1,523	1,000	1,000	1,000	.....	.....	.....	.....
Spain	189,919	232,612	198,829	143,524	171,472	147,406	172,909	169,709	125,721	142,000
Sweden	1,100	1,300	1,235	1,630	2,530	2,160	3,170	2,240	830	800
United Kingdom	26,000	29,200	30,500	19,584	15,767	12,890	11,430	11,083	10,441	10,000
Total Europe	500,819	580,512	566,577	519,817	411,685	380,387	369,776	341,865	225,780	248,915
Asia:										
Turkey	12,400	12,500	13,900	6,000	1,200	1,200	3,000	2,500	1,000	1,000
India (Burma)	.....	.....	5,931	10,218	7,059	11,266	17,137	19,380	18,827	24,197
Japan	4,125	3,733	3,777	4,562	4,764	11,370	15,806	10,684	5,771	5,000
Total Asia	16,525	16,233	23,608	20,780	13,023	23,836	35,943	32,564	25,598	30,197
Australia	99,600	107,400	110,400	94,950	95,000	141,232	162,568	177,810	81,682	11,713
Africa (Rhodesia)	.....	.....	.....	.....	485	1,264	3,882	9,308	12,859	13,900
Grand totals	1,123,005	1,207,072	1,177,481	1,167,219	1,063,006	1,126,657	1,165,434	1,141,023	863,706	841,693

World's Production of Zinc

(In Metric Tons—2,204.6 Lb.)

Country	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
United States	267,472	314,512	320,283	335,935	460,076	616,908	619,079	476,594	427,909	435,153
Canada	.....	.....	.....	.....	.....	2,698	9,058	11,407	11,182	16,795
Belgium	195,092	200,198	204,220	145,925	51,660	22,930	10,290	9,245	19,860	83,046
France	57,105	64,269	67,890	42,473	19,180	20,258	22,929	18,347	10 800	19,655
Germany	247,900	269,200	278,800	236,000	185,357	178,015	186,500	171,900	85,000	97,465
Great Britain	66,956	57,231	66,243	50,800	52,426	52,629	51,918	39,001	38,227	25,000
Italy	.....	.....	.....	.....	.....	258	367	1,188	1,282	1,400
Austria-Hungary	16,876	19,604	21,707	15,100	9,500	11,600	12,600	12,000	.....	.....
Jugo-Slavia and Czechoslovakia	.....	.....	.....	.....	.....	.....	.....	.....	4,010	6,000
Netherlands	22,733	23,932	24,323	16,543	11,130	12,101	4,059	681	.....	2,031
Norway	6,680	8,128	9,287	1,702	1,975	1,833	1,752	1,855	3,386	1,837
Poland	9,936	8,763	7,610	9,517	5,480	7,472	8,334	4,893	2,477	2,785
Spain	2,904	4,067	3,312	8,780	6,402	6,500	7,500	10,000	10,000	6,300
Sweden	1,000	1,500	2,000	2,300	8,600	10,000	8,000	4,100	2,320	1,450
Australia }	1,727	2,296	4,187	4,572	4,674	4,826	3,607	5,537	3,404	3,920
Tasmania }	.....	.....	.....	.....	.....	.....	51	3,556	4,877	5,900
Japan	.....	.....	900	5,881	21,137	38,993	54,718	39,908	19,816	10,885
Totals	896,381	964,937	1,010,762	875,528	837,597	987,021	1,000,726	810,212	644,550	719,394

COMPANY REPORTS

Cerro de Pasco Earned 69c. a Share in 1920

A report of operations of Cerro de Pasco Copper Corp. for 1920 shows a balance of $618,433 after interest, depreciation, depletion and federal taxes, compared with $2,283,628 in 1919. Profit and loss account follows:

Inventory — Dec. 31, 1919	$7,518,035.82	Sales of copper, silver and gold	$11,463,572.25
Operating, smelting, refining and administration expenses	8,417,195.34	Dividends and interest	2,319,890.66
Custom ores	2,043,287.93	Miscellaneous receipts	35,174.91
United States and foreign taxes	621,576.46	Inventory, Dec. 31, 1920	9,042,612.37
Reserve:			
Depletion of mines	2,781,663.42		
Depreciation of plant and machinery	791,058.16		
U. S. income tax, 1920	70,000.00		
Net earnings	618,433.06		
	$22,861,250.19		$22,861,250.19

SURPLUS ACCOUNT

Adjustment of reserves, capital:		Balance—Dec. 31, 1919	$10,273,493.58
Surplus, etc	$5,708,166.13	Profit—Jan. 1 to Dec. 31, 1920 (see net earnings above)	618,433.06
Dividends paid	3,592,917.00		
Balance	1,590,843.51		
	$10,891,926.64		$10,891,926.64

Capitalization, 898,230 shares of no par value.

Jim Butler Tonopah Mining Co.

A report of operations of the Jim Butler Tonopah Mining Co. for 1920 shows that the gross value of production was $263,658.44, from 12,616 dry tons of ore. The total earnings from Tonopah operations were $38,921.32; from the lease to West End Consolidated, $21,025.59; from other leases and miscellaneous income, $10,285.91. Operating statement follows:

Balance of cash in banks Dec. 31, 1919			$3,331.22
Receipts:			
Shipments of ore, (including lessees' ore)		$123,342.51	
Sale of Liberty Loan bonds—$55,000		48,708.53	
Interest received on Liberty Loans		637.50	
Interest received on bank deposits		136.07	
Other collections		8,291.67	181,116.28
			$184,447.50
Disbursements:			
Operation of mine and conduct of business, including payments to lessees for ore		$102,300.52	
Net disbursements, quarter interest in:			
Belmont Shawmut Mining Co.	$70,865.59		
Less one-quarter net proceeds of ore during 1920	38,944.56	31,921.03	
Belmont Wagner Mining Co.	78,295.77		
Less one-quarter net proceeds of ore during 1920	28,987.85	49,307.92	183,529.47
Balance of cash in banks Dec. 31, 1920			(a) $918.03

(a) Due from ore shipped, $6,266.15

Hedley Gold Mining Co.

A report of operations of the Hedley Gold Mining Co. for 1920 states that $324,985.55 in gold and silver was produced. Balance sheet follows:

ASSETS

Fixed		
Mines and mining claims, buildings, plant	$2,016,547.63	
Capital stock, the Similkameen Water Works Co., Ltd	6,000.00	
Copper Flat property	200,000.00	$2,222,547.63
Deferred		
Supplies—mdse., cyanide, etc		73,844.03
Current		
Accounts receivable	$22,682.57	
Cash in banks	119,921.55	$142,604.12
		$2,438,995.78

LIABILITIES

Capital stock authorized and issued (240,000 shares, par value $10 each.)		$2,400,000.00
Current accounts payable		716.48
Reserve for insurance, etc		31,899.98
Surplus, balance, Dec. 31, 1919	$8,319.91	
Less deficit, year ended Dec. 31, 1920	1,940.59	6,379.32
		$2,438,995.78

Greene Cananea Surplus Increases

A report of operations of Greene Cananea Copper Co. for 1920 states that 43,672,939 lb. of copper, 1,778,618 oz. of silver, and 10,090 oz. of gold were produced. The cost of copper production was 16.304c. per lb. (including all expenses and Federal taxes); the price received was 18.013c. per lb. Income account follows:

Income:			
Sales of metals			$7,142,208.17
Miscellaneous receipts			157,710.67
			$7,299,918.84
Expenses:			
Mining		$3,630,781.14	
Reduction		3,120,492.79	
Refining and selling		1,096,198.80	
Administration and taxes		996,429.56	
Metals in process and on hand Jan. 1, 1920		4,516,383.63	
		$13,360,285.92	
Metals in process and on hand Dec. 1, 1920		6,979,941.25	6,380,344.67
			$919,574.17
Expenditures on buildings and equipment written off			311,081.59
			$608,492.58
Interest paid			48,414.08
Balance, net income for year			$560,078.50

Surplus balance on Dec. 31, 1919, was $7,837,309.32. Adding net income of $560,078.50 and subtracting dividends totaling $500,000, leaves a balance Dec. 31, 1920, of $7,897,387.82.

United Eastern Dividends, $981,360

A report of operations of United Eastern Mining Co. for 1920 states that 104,222.5 oz. of gold and 78,011 oz. of silver were recovered in the period named, valued at $2,173,914.28. Income account follows:

Values recovered:			
Gold		$2,087,558.39	
Silver		80,463.87	$2,168,022.26
Miscellaneous income			24,611.51
			$2,192,633.77
Deduct:			
Mining costs		$534,489.92	
Development		54,854.76	
Depletion		672,916.29	
Milling		208,267.54	
Depreciation on plant, etc		32,035.86	
Marketing		12,396.81	
Taxes:			
State and county	$92,494.60		
Capital stock	3,812.97		
1919 Federal income and profit taxes	32,560.92	128,868.49	
Casualty reserve		29,603.81	
Superintendence		11,688.01	
Administrative and general expense		48,669.23	
Litigation expense		63,719.46	
Miscellaneous		2,505.01	$1,800,015.19
Net income before providing for 1920 Federal income and profit taxes			$392,618.58

Capital surplus Dec. 31, 1919, after deducting depletion, was $1,576,271.22. Adding net income of $392,618.58 and deducting distributions to stockholders in 1920 of $981,360, leaves a surplus Dec. 31, 1920, of $987,529.80. Capitalization, 1,363,000 shares, of $1 each, outstanding.

Camp Bird Surplus Decreases

A report of operations of Camp Bird, Ltd. (British) for the fiscal year ended June 30, 1920, states that £50,320 16s. was realized on investments and £58,917 19s. was received in dividends from subsidiary companies. Profit-and-loss account shows a profit of £64,717 14s., to which has been added £53,462 2s., brought forward from last year, giving a total of £118,179 16s., from which preference dividends totaling £45,473 15s. and tunnel advances amounting to £35,265 16s. have been deducted, leaving a balance of £37,440 5s. No milling operations were carried on during the year in Colorado.

MINING STOCKS

Week Ended June 11, 1921

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Adventure	Boston	⅛	⅛	⅛		
Ahmeek	Boston	50¼	47½	47½	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	1/16	1/16	1/16		
Allouez	Boston	21	21	21	Mar. '19	1.00
Anaconda	New York	40	37½	38¾	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2⅛	2	2		
Ariz. Com'l	Boston	8¼	8⅛	8⅛	Oct. '18,	.50
Big Ledge	N. Y. Curb	1/16	¼	1/16		
Bingham Mines	Boston	....	....	10	Sept. '19, Q	.25
Calumet & Arizona	Boston	49	45½	46¾	Mar. '21, Q	.50
Calumet & Hecla	Boston	245	240	240	June 20, Q	5.00
Canada Copper	N. Y. Curb	‡...	....	*13		
Centennial	Boston	....	....	7⅞	Dec. '18, SA	1.00
Cerro de Pasco	New York	27⅛	25⅛	25½	Mar. '21, Q	.50
Chile Copper	New York	11⅜	10⅛	10⅛		
Chino	New York	24⅛	23⅛	23⅜	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	‡...	....	*26½		
Con. Arizona	N. Y. Curb	....	....	1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	....	....	1¼		
Copper Range	Boston	34½	32⅛	32⅛	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*39	*29	*34		
Davis-Daly	Boston	6⅝	6½	6½	Mar. '20, Q	.25
East Butte	Boston	9⅛	8⅛	8⅛	Dec. '19, A	.50
First National	Boston Curb	*58	*51	*56	Feb. '1., SA	.15
Franklin	Boston	2⅛	2	2		
Gadsden Copper	N. Y. Curb	....	....	*25		
Granby Consol.	New York	21¼	20⅛	20⅛	May '19, Q	1.25
Greene-Cananea	New York	23⅛	22	22⅛	Nov. '20, Q	.50
Hancock	Boston	3	2⅞	2⅞		
Howe Sound	N. Y. Curb	....	....	2¼	Jan. '21, Q	.05
Inspiration Consol.	New York	34	32⅜	33⅛	Oct. '20, Q	1.00
Iron Cap	Boston Curb	6⅜	6⅛	6⅜	Sept. '20, K	.25
Isle Royale	Boston	21⅛	20	20	Sept. '19, SA	.50
Kennecott	New York	20⅛	18⅛	19⅛	Dec. '20, Q	.50
Keweenaw	Boston	....	....	1⅜		
Lake Copper	Boston	2⅜	2⅛	2⅛		
La Salle	Boston	....	....	2		
Magma Chief	N. Y. Curb	....	....	*21		
Magma Copper	N. Y. Curb	19	18⅛	19	Jan. '19, Q	.50
Majestic	Boston Curb	....	....	*8		
Mason Valley	Boston	1⅛	1⅛	1⅛		
Mass Consolidated	Boston	2⅛	2	2⅛	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	4⅛	3½	3½		
Miami Copper	New York	22⅜	20⅛	21	May '21, Q	.50
Michigan	Boston	2	2	2		
Mohawk	Boston	50	48	49	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5⅛	4⅞	5		
Nevada Consol.	New York	11⅛	‡10⅜	10⅜	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3		
New Cornelia	Boston	15	14⅛	14⅛	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	....	....	*5		
North Butte	Boston	10⅛	9⅛	9⅛	Oct. '18, Q	.25
North Lake	Boston	⅜	⅜	⅜		
Ohio Copper	N. Y. Curb	....	....	1/16		
Old Dominion	Boston	....	....	21	Dec. '18, Q	1.00
Osceola	Boston	28	27	28	June '20, Q	.50
Phelps Dodge	Open Mar.	†160	†150	....	Apr. '21, Q	1.00
Quincy	Boston	39	37	37	Mar. '20, Q	1.00
Ray Consolidated	New York	13⅛	12⅛	12⅜	Dec. '20, Q	.25
Ray Hercules	Boston Curb	....	....	*35		
St. Mary's Min. Ld.	Boston	38	37	37	June '20, K	2.00
Seneca Copper	Boston	16⅛	15	15		
Shannon	Boston	....	....	0.90	Nov. '17, Q	.25
Shattuck Arizona	New York	7	6⅛	6½	Jan. '20, Q	.25
South Lake	Boston	....	....	1		
Superior Copper	Boston	....	....	3⅛	Apr. '17,	1.00
Superior & Boston	Boston	1 7/16	1⅛	1⅛		
Tenn. C. & C. cfs	New York	8⅛	8	8	May '18, I	1.00
Toulumne	Boston	*65	*60	*60	May '13,	.10
United Verde Ex.	Boston Curb	26⅛	25	26	May '21, Q	.25
Utah Consol.	Boston	4	3⅛	3⅛	Sept. '18,	.25
Utah Copper	New York	52⅞	47⅛	49⅛	Mar. '21, Q	1.00
Utah Metal & T.	Boston	1 9/16	1⅛	1 9/16	Dec. '17,	.30
Victoria	Boston	....	....	1⅛		
Winona	Boston	....	....	*40		
Wolverine	Boston	10⅛	10⅛	10⅛		
NICKEL-COPPER						
Internat. Nickel	New York	14⅞	13⅞	14⅛	Mar. '19,	.50
Internat. Nickel, pf.	New York	....	....	82⅛	May '21, Q	1.50
LEAD						
National Lead	New York	76	73½	73½	Mar. '21, Q	1.50
National Lead, pfd.	New York	102	102	102	Mar. '21, Q	1.75
St. Joseph Lead	New York	12	11	12	Mar. '21, Q	.25
Stewart Mining	Boston Curb	....	....	*6	Dec. '15,	.05
ZINC						
Am. Z. L. & S.	New York	9	8	8⅛	May '20,	1.00
Am. Z. L. & S, pfd.	New York	28⅛	27⅛	27⅛	Nov. '20, Q	1.50
Butte C. & Z.	New York	4⅛	4⅛	4⅛	June '18,	.50
Butte & Superior	New York	12⅞	12⅛	12⅛	Sept. '20,	1.25
Callahan Zn-Ld	New York	5	4⅛	4⅛	Dec. '20, Q	.50
New Jersey Zn	N. Y. Curb	126	125	125	May '21, Q	2.00
Success	N. Y. Curb	*3	*1⅛	*2	July '16,	.03
Yellow Pine	Los Angeles	*65	*53	*55	Sept. '20, Q	.03

* Cents per share. † Bid or asked. ‡Quotations missing. Q, Quarterly. SA, Semi-annualy. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	⅜	⅛	⅜		
Alaska Juneau	New York	1⅜	1⅛	1⅛		
Carson Hill	N. Y. Curb	13½	13⅛	13⅛		
Cresson Consol. G.	N. Y. Curb	1⅛	1 1/16	1⅛	June '20, Q	$0.10
Dome Extension	Toronto	....	....	*75		
Dome Mines	New York	18⅛	17	17	Apr. '21, Q	.25
Golden Cycle	Colo. Springs	*74	*71⅞	*71⅞	Dec. '20, Q	.02
Goldfield Consol.	N. Y. Curb	*7	*6	*7	Dec. '19,	.05
Hollinger Consol.	Toronto	7.25	7.00	7.00	Feb. '21, M	.05
Homestake Mining	New York	57⅛	57	57	May '21,	.25
Kirkland Lake	Toronto	*47⅛	*45	*45		
Lake Shore	Toronto	1.22	1.20	1.20	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	1.92	1.89	1.89	Jan. '21, K	.05
Porcupine Crown	Toronto	*21	*14	*15	July '17,	.03
Portland	Colo. Springs	....	....	*59½	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*4	*3	*3½	May '19,	.05
Silver Pick	N. Y. Curb	*5	*3	*3		
Teck Hughes	Toronto	*14½	*12½	12½		
Tom Reed	Los Angeles	*87½	*73	*73	Dec. '19,	.02
United Eastern	N. Y. Curb	2 7/16	2 7/16	2⅛	Apr. '21, Q	.15
Vindicator Consol.	Colo. Springs	*37½	*36	*37½	Jan. '20, Q	.01
West Dome Consol.	Toronto	*6½	*5½	*5½		
White Caps Mining	N. Y. Curb	*8	*6	*8		
Yukon Gold	N. Y. Curb	1⅛	1	1⅛	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*27	*19	*19	Apr. '20, M	.03
Batopilas Mining	New York	⅜	⅜	⅜	Dec. '07, I	.12½
Beaver Consol.	Toronto	*32½	*31	*31	May '20, K	.03
Coniagas	Toronto	1.70	1.70	1.70	May '21, Q	.12½
Crown Reserve	Toronto	*12⅛	*11	*11	Jan. '17,	.05
Kerr Lake	Boston	2⅜	2⅜	2⅜	Apr. '21, Q	.12½
La Rose	Toronto	*20	*18½	*20	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*20	*20	*20	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.26	1.15	1.15	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	4½	4½	4½	Apr. '21, Q	.15
Ontario Silver	New York	....	....	5	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	....	....	2	Jan. '12,	.10
Peterson Lake	Toronto	*5	*5	*5	Jan. '17,	.01
Temiskaming	Toronto	....	....	*18	Jan. '20, K	.04
Trethewey	Toronto	*16	*16	*16	Jan. '19,	.05
GOLD AND SILVER						
Atlanta	N. Y. Curb	*1	*¾	*1		
Barnes-King	Butte	‡...	....	1.10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*62	*54	*59		
Cashboy	N. Y. Curb	*5½	*4	*5		
El Salvador	N. Y. Curb	....	....	⅛		
Jim Butler	N. Y. Curb	*10	*7	*8	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*6½	*4½	*5	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	⅛		
MacNamara M.& M.	N. Y. Curb	*17	*15	*16	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1 1/16	1⅛	1 1/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1⅛	1	1 1/16		
Tonopah-Extension	N. Y. Curb	1⅛	1⅛	1⅛	Apr. '21, Q	.05
Tonopah Mining	N. Y. Curb	1 1/16	1⅛	1⅛	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	1	⅞	⅞	Dec. '19, SA	.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*10	*8	*9	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	‡...	....	1.10	Dec. '21,	.15
Chief Consol.	Boston Curb	2⅛	2⅛	2⅛	May '21, Q	.05
Consol. M. & S.	Montreal	16⅛	15⅛	15⅛	Oct. '20, Q	.62½
Daly Mining	Salt Lake	‡...	....	1.50	July '20, Q	.10
Daly-West	Boston	....	....	3	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	....	....	2⅛	Apr. '21, K	.05
Electric Point	Spokane	*7	*7	*7	May '20, SA	.03
Federal M. & S.	New York	6⅛	6⅛	6⅛	Jan. '09,	1.50
Federal M. & S., pfd	New York	24⅜	22⅛	23	Mar. '21, Q	1.00
Florence Silver	Spokane	....	....	*12½	Apr. '19,	.01½
Grand Central	Salt Lake	‡...	....	*07½	June '20, K	.03
Hecla Mining	N. Y. Curb	4	3 13/16	4	Mar. '21, Q	.15
Iron Blossom	N. Y. Curb	*15	*15	*15	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	‡...	....	3.00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	....	....	*6½		
Prince Consol.	N. Y. Curb	⅜	1/16	⅜	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*5	*4	*4	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*8½	*7	*7½		
South Hecla	Salt Lake	‡...	....	*53	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	⅛	⅛	⅛	Oct. '17,	.05
Tamarack-Custer	Spokane	1.95	1.85	1.90	Jan. '21, K	.04
Tintic Standard	Salt Lake	‡...	....	2.40	June '20, Q	.10
Utah Apex	Boston	2⅛	2⅛	2⅛	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	3⅛	2	2	Nov. '17,	.01
QUICKSILVER						
New Idria	Boston	†*50	†....	*50	Jan. '19,	.25
VANADIUM						
Vanadium Corp.	New York	29⅜	27⅛	27⅛	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	58	57⅛	58	Apr. '21, Q	1.50
Asbestos Corp., pfd.	Montreal	79	78	78	Apr. '21, Q	1.75
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	40⅜	37⅛	39	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf	New York	76	72⅜	73	June '21, Q	1.75
Am. Sm. pf. A	New York	72⅛	72⅛	72⅛	Apr. '21, Q	1.50
U. S. Sm. R. & M.	New York	33	31⅛	32	Jan. '21, Q	.50
U.S.Sm.R.& M. pf.	Boston	41⅛	41	41	Apr. '21, Q	.87½